Operator Manual

Standby Power Generator Set, PowerCommand® Controller

C20 N6 (Spec A), C22 N6 (Spec A)
C25 N6 (Spec A), C30 N6 (Spec A)
C36 N6 (Spec A), C40 N6 (Spec A)
C30 N6H (Spec A), C36 N6H (Spec A)
C40 N6H (Spec A), C45 N6H (Spec A)
C50 N6H (Spec A), C60 N6H (Spec A)

English
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1 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS.

This manual contains important instructions for the generator set. Follow these instructions during installation, operation, and maintenance of the generator set and batteries.

Thoroughly read the Operator Manual before operating the generator set. Safe operation and top performance can only be obtained when the equipment is properly operated and maintained.

1.1 Warning, Caution, and Note Styles Used In This Manual

The following safety styles and symbols found throughout this manual indicate potentially hazardous conditions to the operator, service personnel, or the equipment.

⚠ DANGER
Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION
Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE
Indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

1.2 General Information

This manual should form part of the documentation package supplied by Cummins Power Generation with specific generator sets. In the event that this manual has been supplied in isolation please contact your authorized dealer.

NOTICE
Its is in the operator's interest to read and understand all warnings and cautions contained in the documentation relevant to the generator set operation and daily mainteance.

1.3 General Precautions

- Keep ABC fire extinguishers accessible.
- Make sure that all fasteners are secure and torqued properly.
- Keep the generator set and its compartment clean. Do not store any items in the generator set compartment.
- Before working on the generator set:
  1. Press the Stop Switch and disable AUTO mode.
  2. Disconnect AC power from any battery chargers.
  3. Remove the negative (–) battery cable from the battery to prevent it from contacting the battery terminal post.
- Use caution when making adjustments when the generator set is running, hot, or when parts are electrically live, as all situations may cause personal injury or death.
- Used engine oil has been identified by some state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or come into contact with used oil or its vapors.
- Do not work on the generator set when mentally or physically fatigued or after consuming alcohol or drugs.

NOTICE
Only trained and authorized personnell shall maintain or service the generator set.

General Safety Precautions

⚠ WARNING
Coolants under pressure can cause severe scalding. Do not open a radiator or heat exchanger pressure cap while the engine is running. Let the engine cool down before removing the coolant pressure cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.

⚠ WARNING

Moving parts can cause severe personal injury or death and hot exhaust parts can cause severe burns. Make sure all protective guards are properly in place before starting the generator set.

⚠ WARNING

Used engine oils have been identified by some state and federal agencies to cause cancer or reproductive toxicity. Do not ingest, breathe the fumes, or contact used oil when checking or changing engine oil.

⚠ WARNING

Operation of equipment is unsafe when mentally or physically fatigued. Do not operate equipment in this condition, or after consuming any alcohol or drug.

⚠ WARNING

Substances in exhaust gases have been identified by some state and federal agencies to cause cancer or reproductive toxicity. Do not breathe in or come into contact with exhaust gases.

⚠ WARNING

Flammable liquids can cause fire or explosion. Do not store fuel, cleaners, oil, etc. near the generator set.

⚠ WARNING

Wear hearing protection when going near an operating generator set .

⚠ WARNING

Hot metal parts can cause severe burns. Avoid contact with the radiator, turbo charger, and exhaust system.

⚠ WARNING

Maintaining or installing a generator set can cause severe personal injury. Wear personal protective equipment such as safety glasses, protective gloves, hard hats, steel-toed boots, and protective clothing when working on equipment.

⚠ WARNING

Ethylene glycol, used as engine coolant, is toxic to humans and animals. Clean up coolant spills and dispose of used antifreeze in accordance with local environmental regulations.

⚠ WARNING

Starting fluids, such as ether, can cause explosion and generator set engine damage. Do not use.

⚠ CAUTION

Stepping on the generator set can cause parts to bend or break, leading to electrical shorts, or to fuel, coolant, or exhaust leaks. Do not step on the generator set when entering or leaving the generator room.

⚠ CAUTION

To prevent accidental or remote starting while working on the generator set, disconnect the negative (–) battery cable at the battery using an insulated wrench.

⚠ CAUTION

Make sure that rags are not left on or near the engine.

⚠ CAUTION

Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.

⚠ CAUTION

Accumulated grease and oil can cause overheating and engine damage presenting a potential fire hazard. Keep the generator set clean and repair any oil leaks promptly.

⚠ CAUTION

Before performing maintenance and service procedures on enclosed generator sets, make sure the service access doors are secured open.

⚠ CAUTION

Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.

NOTICE

Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquid fuels and gaseous fuels. Class C fires involve live electrical equipment. (Refer to NFPA No. 10 in applicable region.)

1.4 Generator Voltage is Deadly

- Generator output connections must be made by a trained and experienced electrician in accordance with all applicable codes.
- This generator set and the public utility may only be connected to house circuits by means of the automatic transfer switch.

⚠ CAUTION
Improper connections can lead to electrocution of utility workers and damage to equipment. Make sure that the connections are installed properly by a trained technician.

- Use caution when working on live electrical equipment. Remove jewelry, and make sure clothing and shoes are dry. Stand on a dry wooden platform.

1.5 Engine Exhaust is Deadly

- See **The Hazards of Carbon Monoxide** to learn the symptoms of Carbon Monoxide poisoning.
- Locate the generator set away from doors, windows, other openings into the house, and where exhaust gases will disperse away from the house.

1.6 Fuel is Flammable and Explosive

- Keep flames, cigarettes, sparks, pilot lights, electrical arc-producing equipment, switches, and all other sources of ignition away from areas where fuel fumes are present and areas sharing ventilation.
- Fuel lines must be secured, free of leaks, and separated or shielded from electrical wiring.
- Leaks can lead to explosive accumulations of gas. Prevent leaks and the accumulation of gas. A rotten egg smell indicates a possible natural gas or propane leak.
  - Natural gas rises when released and can accumulate under hoods and inside housings and buildings.
  - Propane sinks when released and can accumulate inside housings and basements and other below-grade spaces.

1.7 Batteries Can Explode

Batteries can explode, causing severe skin and eye burns and can release toxic electrolytes.

⚠ WARNING

Do not dispose of the battery in a fire, because it is capable of exploding. Do not open or mutilate the battery. Released electrolytes have been known to be harmful to the skin and eyes and to be toxic. Batteries present the risk to high short circuit current. Remove watches, rings, or other metal objects, and use tools with insulated handles.

- Wear safety glasses.
- Do not smoke.
- To prevent arcing when disconnecting the battery:
  1. Press the Stop Switch.
  2. Disconnect AC power from any battery chargers.
  3. Remove the negative (-) battery cable to prevent starting.
- To prevent arcing when reconnecting the battery:
  1. Reconnect the positive (+) cable.
  2. Reconnect the negative (-) cable.
  3. Reconnect the battery charger to AC power supply.
- When replacing the generator set battery, always replace it with a battery as specified in the **Model Specifications** section of this manual.

1.8 Moving Parts Can Cause Severe Personal Injury or Death

- Do not wear loose clothing or jewelry near moving parts, such as fans.
- Keep hands away from moving parts.
- Keep guards in place over fans.

1.9 The Hazards of Carbon Monoxide

Carbon Monoxide (CO) is an odorless, colorless, tasteless and non-irritating gas (you cannot see it or smell it). Exposure even to low levels of CO for a prolonged period can lead to asphyxiation (lack of Oxygen), resulting in death. Mild effects of CO poisoning include eye irritation, dizziness, headaches, fatigue, and the inability to think clearly. More extreme symptoms include vomiting, seizures, and collapse.

Engine-driven generators produce harmful levels of carbon monoxide that can injure or kill you.

What Is Carbon Monoxide Poisoning?

Carbon Monoxide (CO) is an odorless, colorless, tasteless and non-irritating gas. You cannot see it or smell it. Red blood cells, however, have a greater affinity for CO than for Oxygen. Therefore, exposure even to low levels of CO for a prolonged period can lead to asphyxiation (lack of Oxygen) resulting in death. Mild effects of CO poisoning include eye irritation, dizziness, headaches, fatigue and the inability to think clearly. More extreme symptoms include vomiting, seizures and collapse.

Special Risks of CO Near the Home

Residents can be exposed to lethal levels of CO when the generator set is running. Depending on air temperature and wind, CO can accumulate in or near the home.

To protect yourself and others from the dangers of CO poisoning, it is recommended that reliable, approved, and operable CO detector alarms are installed in proper locations in the home as specified by their manufacturer.

⚠ WARNING

Carbon Monoxide (CO) gas can cause nausea, fainting, or death.

Protecting Yourself From CO Poisoning

- Locate the generator in an area where there are no windows, doors, or other access points into the home.
- Make sure all CO detectors are installed and working properly.
- Pay attention for signs of CO poisoning.
- Check the exhaust system for corrosion, obstruction, and leaks every time you start the generator set and every eight hours when you run it continuously.

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2 Introduction

This generator set is intended for stationary installation for emergency use only.

2.1 About this Manual

This manual is a guide for the operation of the generator set models listed on the front cover. Each operator of this generator set should become familiar with the information in this manual and observe all of the instructions and precautions.

The purpose of this manual is to provide the user with general operating information. This manual provides guidance and assistance with recommendations for correct and safe procedures. Cummins Power Generation (CPG) cannot accept any liability whatsoever for problems arising as a result of following recommendations in this manual. The information contained within the manual is based on information available at the time of issue. In line with Cummins Power Generation policy of continuous development and improvement, information may change at any time without notice. The users should therefore make sure that before commencing any work, they have the latest information available. Consult your authorized dealer for further installation information. It is essential that the utmost care is taken with the application, installation, and operation of any generator set due to their potentially hazardous nature. Careful reference should also be made to other Cummins Power Generation literature. Should you require further assistance, contact your authorized dealer.

NOTICE

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

- **This device may not cause harmful interferences.**
- **This device must accept any interference received, including interference that may cause undesired operation.**

2.2 Icons

The following symbols may have been used in this manual to help communicate the intent of the instructions. They are defined below.

Icon	Description
	Clean the part or assembly.
	Indicates an **electrical** measurement.
	Indicates that an **inspection** is required.
	Indicates an **installation** or **assembly** procedure.
	Lubricate the part or assembly.
	Indicates a **mechanical** or **time** measurement.
	Refer to another publication for additional information.
	Indicates a **removal** or **disassembly** step.
	Tighten to a specific torque.
	Indicates **parts** or **tools** required.
	Indicates that the component is **heavy** (50 lb or 23 kg or more). To reduce the possibility of personal injury, use a hoist or get assistance to lift.

2.3 Schedule of Abbreviations

This list is not exhaustive. For example, it does not identify units of measure or acronyms that appear only in parameters, event/fault names, or part/accessory names.

AmpSentry, INSITE, and InPower are trademarks of Cummins Inc. PowerCommand is a registered trademark of Cummins Inc.

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
AC	Alternating Current	LCT	Low Coolant Temperature
AMP	AMP, Inc., part of Tyco Electronics	LED	Light-emitting Diode
ANSI	American National Standards Institute	MFM	Multifunction Monitor
ASTM	American Society for Testing and Materials (ASTM International)	Mil Std	Military Standard
ATS	Automatic Transfer Switch	NC	Normally Closed
AVR	Automatic Voltage Regulator	NC	Not Connected
AWG	American Wire Gauge	NFPA	National Fire Protection Agency
CAN	Controlled Area Network	NO	Normally Open
CB	Circuit Breaker	NWF	Network Failure
CE	Conformité Européenne	OEM	Original Equipment Manufacturer
CFM	Cubic Feet per Minute	OOR	Out of Range
CGT	Cummins Generator Technologies	OORH / ORH	Out of Range High
CMM	Cubic Meters per Minute	OORL / ORL	Out of Range Low
CT	Current Transformer	PB	Push Button
DC	Direct Current	PCC	PowerCommand® Control
DPF	Diesel Particulate Filter	PGI	Power Generation Interface
ECM	Engine Control Module	PGN	Parameter Group Number
ECS	Engine Control System	PI	Proportional/Integral
EMI	Electromagnetic interference	PID	Proportional/Integral/Derivative
EN	European Standard	PLC	Programmable Logic Controller
EPS	Engine Protection System	PMG	Permanent Magnet Generator
E-Stop	Emergency Stop	PT	Potential Transformer
FAE	Full Authority Electronic	PTC	Power Transfer Control

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
FMI	Failure Mode Identifier	PWM	Pulse-width Modulation
FSO	Fuel Shutoff	RFI	Radio Frequency Interference
Genset	Generator Set	RH	Relative Humidity
GCP	Generator Control Panel	RMS	Root Mean Square
GND	Ground	RTU	Remote Terminal Unit
HMI	Human-machine Interface	SAE	Society of Automotive Engineers
IC	Integrated Circuit	SPN	Suspect Parameter Number
ISO	International Organization for Standardization	SW_B+	Switched B+
LBNG	Lean-burn Natural Gas	UL	Underwriters Laboratories
LCD	Liquid Crystal Display	UPS	Uninterruptible Power Supply

2.4 Related Literature

The literature provided with the generator set is as follows.

- Installation Manual (A045R241)
- Operator Manual (A045R242)

⚠ CAUTION
A generator set must be operated and maintained properly if you are to expect safe and reliable operation. The Operator Manual includes a maintenance schedule and a troubleshooting guide. ***The Health and Safety Manual must be read in conjunction with this manual for the safe operation of the generator set:***

- Health and Safety Manual (0908-0110)
- Warranty Statement (A028U870)
- Emissions Component Defect Warranty Statement (A028X278)

The relevant manuals appropriate to your generator set are also available. The documents below are in English:

- Service Manual (A045R243)
- Parts Manual (A046Z674)
- E-Controls, Inc. Service Manual (A035C596)

- Global Control Platform (GCP) Engine Display Interface Software (EDIS) Training Manual (A035C608)
- RA Series Transfer Switch Owner's Manual (A046S594) - if applicable
- PowerCommand® 1302 Controller Owner's Manual (900-0661)
- Standard Repair Times (SRT) Manual (A046Z094)
- Application Manual T-030 - for application information (A040S369)
- Service Tool Manual (A043D529)

2.5 About the Generator Set

The generator set is an engine-powered generator set fueled by natural gas or propane. See the **Model Specifications** section of this manual for specific information about the generator set.

The generator set is intended as a back-up to utility power. Whenever utility power is interrupted, the house electrical loads are automatically switched by the transfer switch from the utility (normal power source) to the generator set (emergency power source). When utility power is restored, the loads are automatically switched back to the utility. To do this, the generator set and transfer switch perform the following functions together:

1. Senses an interruption of utility power.
2. Starts the generator set.
3. Transfers the load to the generator set when operation has stabilized.
4. Senses the return of utility power.
5. Retransfers the load to the utility.
6. Stops the generator set.

A more in-depth illustration of the operation of the generator set and transfer switch can be found in the **Sequence of Operation** section of this manual.

Generator Set Nameplate

⚠ WARNING
Improper service or replacement of parts can lead to severe personal injury or death and to damage to equipment and property. Service personnel must be qualified to perform electrical and mechanical service.

⚠ CAUTION
Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.

Model, Spec, and Serial Numbers: Be ready to provide the model, spec, and serial numbers on the generator set nameplate when contacting Cummins Power Generation for information, parts, and service. The nameplate is located on the inside of the customer service door on enclosed generator sets.

Record these numbers so that they are easy to find when needed. Each character in these numbers is significant for obtaining the right parts listed in the Parts Catalog. Genuine Cummins Power Generation replacement parts are recommended for best results.

My Generator Set Information	
Model	
Spec	
Serial Number	

2.6 Model Specifications

TABLE 1. 2.4L MODEL VARIATIONS

Model	Description
C20 N6, C22 N6, C25 N6, C30 N6, C36 N6, C40 N6	60 Hz, 1800 RPM
C30 N6H, C36 N6H, C40 N6H, C45 N6H, C50 N6H, C60 N6H	60 Hz, 3600 RPM

TABLE 2. COLD WEATHER SPECIFICATIONS

	All Models
	For NFPA 110 applications, a coolant heater is required. Factory option is available.
Above 40 °F (4 °C)	No starting aids required. Standard battery (group 26)
0 to 40 °F (-17 to 4 °C)	Additional coolant heater and battery charger recommended for starting. Factory options available. Standard battery (group 26)
Below 0 °F (-17 °C)	All starting aides (battery heater, coolant heater, battery charger) recommended. Factory options available. Larger battery (group 24)

TABLE 3. FUEL SPECIFICATIONS 60 HZ, 1800 RPM

	C20 N6	C22 N6	C25 N6	C30 N6	C36 N6	C40 N6
Full load (propane)	105.1 scfh 265,000 BTU/hr	112.7 scfh 285,000 BTU/hr	125.4 scfh 315,000 BTU/hr	164.1 scfh 410,000 BTU/hr	182.7 scfh 460,000 BTU/hr	193.6 scfh 490,000 BTU/hr
Full load (natural gas)	259.6 scfh 270,000 BTU/hr	278.8 scfh 290,000 BTU/hr	309.5 scfh 320,000 BTU/hr	380.9 scfh 395,000 BTU/hr	472.3 scfh 490,000 BTU/hr	519 scfh 540,000 BTU/hr
Fuel pressure	6-14 inch water column					

TABLE 4. FUEL SPECIFICATIONS 60 HZ, 3600 RPM

	C30 N6H	C36 N6H	C40 N6H	C45 N6H	C50 N6H	C60 N6H
Full load (propane)	195.5 scfh 490,000 BTU/hr	219.6 scfh 550,000 BTU/hr	236.2 scfh 595,000 BTU/hr	256.9 scfh 645,000 BTU/hr	289.5 scfh 725,000 BTU/hr	324.6 scfh 820,000 BTU/hr
Full load (natural gas)	476.1 scfh 495,000 BTU/hr	533.3 scfh 555,000 BTU/hr	573.2 scfh 595,000 BTU/hr	623.0 scfh 645,000 BTU/hr	704.7 scfh 730,000 BTU/hr	814.2 scfh 840,000 BTU/hr
Fuel pressure	6-14 inch water column					

TABLE 5. ENGINE SPECIFICATIONS

All Models	
Engine	4 Cylinder-in-line, SOHC, liquid-cooled, 4-stroke, spark ignited
Displacement	144 in^3 (2351 cc)
Spark plug gap	0.040 inch (1.0 mm) (NA) 0.030 inch (0.76 mm) (T/TAA)
Spark plug torque	15 ft-lb (20 N-m)
Oil capacity	Approximately 4.5 quarts (4.3L)
Oil recommendation	5W30 API SM

TABLE 6. GENERATOR SET SIZE SPECIFICATIONS

	20-25 kW 1800 RPM and 30 kW 3600 RPM		30-40 kW 1800 RPM and 36-60 kW 3600 RPM	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
Size (with sound level 1 enclosure)	(L x W x H) 72 x 34 x 45.2 in. (1830 x 864 x 1152 mm)		(L x W x H) 94 x 34 x 45.2 in. (2384 x 864 x 1152 mm)	

TABLE 7. GENERATOR SET WEIGHT (POUNDS) 60 HZ, 1800 RPM

	C20 N6	C22 N6	C25 N6	C30 N6	C36 N6	C40 N6
Sound level 1 (wet)	1109	1109	1147	1279	1356	1424

TABLE 8. GENERATOR SET WEIGHT (POUNDS) 60 HZ, 3600 RPM

	C30 N6H	C36 N6H	C40 N6H	C45 N6H	C50 N6H	C60 N6H
Sound level 1 (wet)	1134	1249	1399	1399	1399	1429

TABLE 9. GENERATOR SPECIFICATIONS 60 HZ, 1800 RPM

	C20 N6	C22 N6	C25 N6	C30 N6	C36 N6	C40 N6
Generator	Brushless, 2-pole rotating field, single bearing					
Power (kVA) 1phase/3 phase	20/25	22/27.5	25/31.3	30/37.5	36/45	40/50
Rated voltages (V)	120/240 1 Ph	120/240 1 Ph	120/240 1 Ph	120/240 1 Ph	120/240 1 Ph	120/240 1 Ph
	120/240 3 Ph	120/240 3 Ph	120/240 3 Ph	120/240 3 Ph	120/240 3 Ph	120/240 3 Ph
	120/208 3 Ph	120/208 3 Ph	120/208 3 Ph	120/208 3 Ph	120/208 3 Ph	120/208 3 Ph
	277/480 3 Ph	277/480 3 Ph	277/480 3 Ph	277/480 3 Ph	277/480 3 Ph	277/480 3 Ph
	347/600 3 Ph	347/600 3 Ph	347/600 3 Ph	347/600 3 Ph	347/600 3 Ph	347/600 3 Ph

TABLE 10. GENERATOR SPECIFICATIONS 60 HZ, 3600 RPM

	C30 N6H	C36 N6H	C40 N6H	C45 N6H	C50 N6H	C60 N6H
Generator	Brushless, 2-pole rotating field, single bearing					
Power (kVA) 1Phase/3 Phase	30/37.5	36/45	40/50	45/56.3	50/62.5	60/75
Rated Voltages (V)	120/240 1 Ph	120/240 1 Ph	120/240 1 Ph	120/240 1 Ph	120/240 1 Ph	120/240 1 Ph
	120/240 3 Ph	120/240 3 Ph	120/240 3 Ph	120/240 3 Ph	120/240 3 Ph	120/240 3 Ph
	120/208 3 Ph	120/208 3 Ph	120/208 3 Ph	120/208 3 Ph	120/208 3 Ph	120/208 3 Ph
	277/480 3 Ph	277/480 3 Ph	277/480 3 Ph	277/480 3 Ph	277/480 3 Ph	277/480 3 Ph

NOTICE
Maximum I_2 = 8%.

TABLE 11. GENERATOR SET DERATING GUIDELINES

Model	NG/LP	Guidelines
C20 N6	NG, LP	Engine power available up to 1005 m (3300 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations derate at 4% per 305m (1000 ft) and 2% per 10 °C above 40 °C (104 °F).
C22 N6	LP	
C30 N6	LP	
C36 N6	NG, LP	
C36 N6H	NG, LP	
C40 N6H	NG, LP	
C45 N6H	LP	
C22 N6	NG	Engine power available up to 670.5 m (2200 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations derate at 4% per 305 m (1000 ft) and 2% per 10 °C above 40 °C (104 °F).
C40 N6	NG, LP	Engine power available up to 114 m (375 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations derate at 4% per 305 m (1000 ft) and 2% per 10 °C above 40 °C (104 °F).
C60 N6H	NG, LP	

Model	NG/LP	Guidelines
C25 N6	NG	Engine power available up to 0 m (0 ft) at ambient temperatures up to 25 °C (77 °F). Above these elevations derate at 4% per 305 m (1000 ft) and 2% per 10 °C above 40 °C (104 °F).
C25 N6	LP	Engine power available up to 114 m (375 ft) at ambient temperatures up to 25 °C (77 °F). Above these elevations derate at 4% per 305 m (1000 ft) and 2% per 10 °C above 25 °C (77 °F).
C50 N6H	NG, LP	
C30 N6	NG	Engine power available up to 762 m (2500 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations derate at 4% per 305 m (1000 ft) and 2% per 10 °C above 40 °C (104 °F).
C30 N6H	NG, LP	Engine power available up to 945 m (3100 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations derate at 4% per 305 m (1000 ft) and 2% per 10 °C above 40 °C (104 °F).
C45 N6H	NG, LP	Engine power available up to 914 m (3000 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations derate at 4% per 305 m (1000 ft) and 2% per 10 °C above 40 °C (104 °F).

TABLE 12. CONTROL SPECIFICATIONS

All Models	
Control	Integrated microprocessor based engine, generator, transfer switch control

TABLE 13. DC SYSTEM SPECIFICATIONS

All Models	
Nominal battery voltage	12 VDC
Battery group	26 standard, 24 high capacity (high capacity battery require an accessory battery tray)
Battery Type	Maintenance free
Minimum cold crank amps	545 standard, 850 high capacity (high capacity battery require an accessory battery tray)

2.7 How to Obtain Service

For parts, service, and product information (such as the Service Manual), contact the nearest authorized Cummins Power Generation dealer. To easily locate the nearest certified distributor/dealer for Cummins generators in your area, or for more information, contact us at 1-800-344-0039 or visit *power.cummins.com.*

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3 Control System

3.1 Operator Panel (HMI211)

The operator panel includes indicator lights (LEDs), display buttons used to navigate through the menus, control mode buttons, and an LCD display. The display enables the operator to check the status, adjust the settings, and start and stop the generator set. The standard operator panel (show below) is located on every generator set. An optional operator panelis also available for location inside the home. For more information about the optional in-home display, see the **In-Home Operator Panel** section.

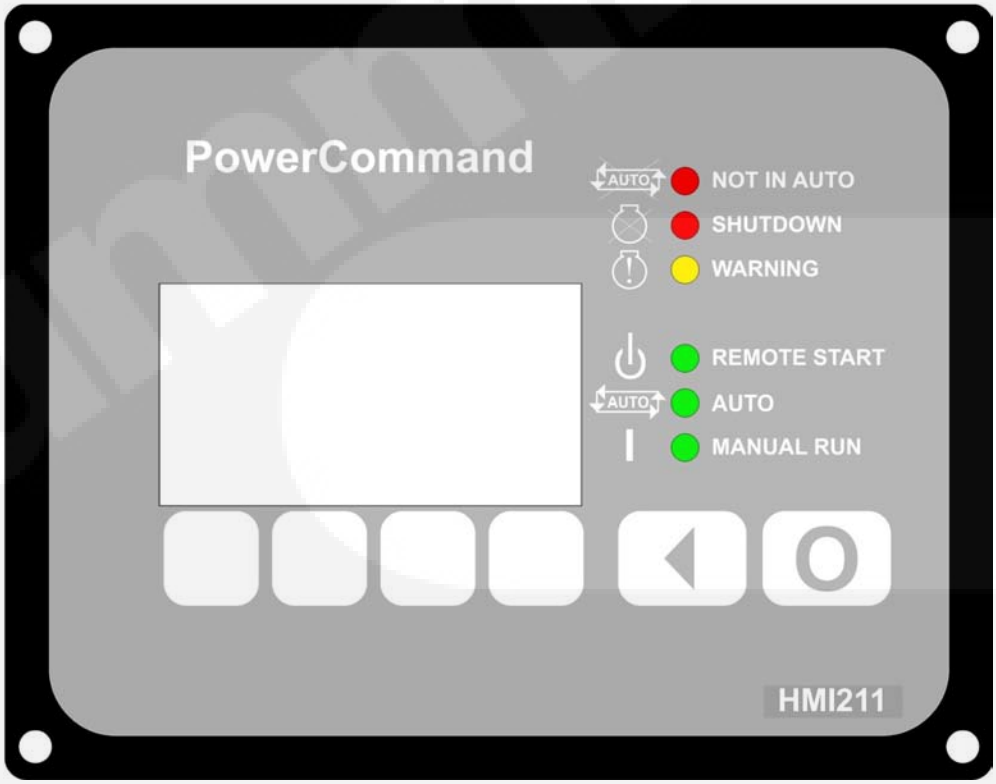


FIGURE 1. STANDARD OPERATOR PANEL (HMI211)

Standard Key Functions (HMI211)

The user interface includes two fixed action buttons and four soft key buttons. The action of the soft key buttons changes to meet the requirements of each screen.

TABLE 14. KEY FUNCTIONS

Key/Symbol	Action
O	Switches to Off mode (fixed action button).
AUTO	Switches to Auto mode.

Key/Symbol	Action
✋	Switches to Manual Run mode.
◄	Navigates to the previous menu level (fixed action button).
▲	(Up Arrow) Navigates to the previous screen/menu in a list.
▼	(Down Arrow) Navigates to the next screen/menu in a list.
▲and ▼	Hold the up and down arrows simultaneously for two seconds from any Info Menu to navigate to the Menu screen.
Save	Saves changes and navigates to the associated screen.
Adjust	Navigates to the Adjust Menu of a specific menu.
→	(Right Arrow) Advances the hightlighted field to the next editable field.
-	Decreases value of the highlighted editable field.
+	Increases value of highlighted editable field.

Standard LED Indicators (HMI211)

The operator panel has six LED indicators. Colors, flashing frequency, and conditions to turn them on/off/blink are included in the table below.

TABLE 15. LED INDICATORS

LED	Color	Action
Not in Auto	Red	Indicates the generator set is in Manual or Off Mode.
Shutdown	Red	Indicates a Shutdown Fault has occurred.
Warning	Yellow	Indicates a Warning Fault has occurred.
Remote Start	Green	Indicates that the generator set has received a Remote Start Command.
Auto	Green	Indicates that the generator set is in Auto Mode. The generator starts when it receives a Remote Start Command.
Manual Run	Green	Indicates that the generator set has received a Manual Run Command.

3.2 In-Home Operator Panel (Accessory)

The in-home operator panel (kit part number A046K103) is an optional display that may be purchased. This panel is intended to serve as a convenient option to the standard operator panel mounted on the generator set.

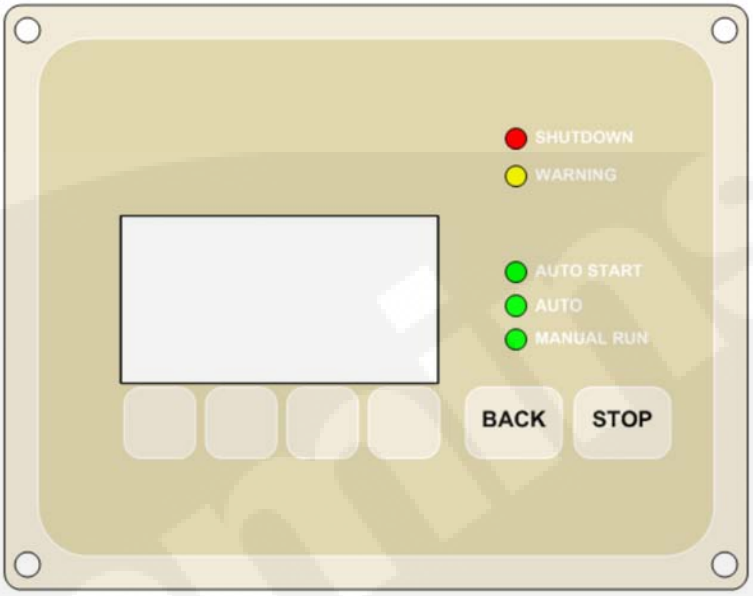


FIGURE 2. IN-HOME OPERATOR PANEL

Key Functions (In-Home Operator Panel)

The user interface includes two fixed action buttons and four soft key buttons. The action of the soft key buttons changes to meet the requirements of each screen.

TABLE 16. KEY FUNCTIONS

Key/Symbol	Action
Stop	Switches to Off mode. This key works from any screen (fixed action button).
▲	(Up Arrow) Navigates to the previous screen/menu in a list.
▼	(Down Arrow) Navigates to the next screen/menu in a list.
▲and ▼	Hold the up and down arrows simultaneously for two seconds from any Info Menu to navigate to the Service Menu.
Back	Navigates to the previous screen/menu in a list (fixed action button). In Adjust screens, settings are not saved.
Save	Saves changes and navigates to the associated screen.
Adjust	Navigates to the Adjust Menu of a specific menu.
➞	(Right Arrow) Advances the hightlighted field to the next editable field.
-	Decreases value of the highlighted editable field.
+	Increases value of highlighted editable field.

LED Indicators (In-Home Operator Panel)

The operator panel has five LED indicators. Colors, flashing frequency, and conditions to turn them on/off/blink are included in the table below.

TABLE 17. LED INDICATORS

LED	Color	Action
Shutdown	Red	Indicates a Shutdown Fault has occurred.
Warning	Yellow	Indicates a Warning Fault has occurred.
Auto Start	Green	Indicates that the generator set has received an Remote Start Command.
Auto	Green	Indicates that the generator set is in Auto Mode. The generator starts when it receives a Remote Start Command.
Manual Run	Green	Indicates that the generator set has received a Manual Run Command.

3.3 Sequence of Operation

NOTICE
The following sequences are based on an approximate time duration. Your generator set may vary slightly from the timing diagrams in this manual. All referenced times are based on default control settings.

Power Outage Sequence

The sequence of operation after a power outage (the generator set is in Auto Mode) is as follows:

1. In normal operation, the utility power is running to the transfer switch and then to the building load, and the generator set is off.
2. The utility power turns off (power outage).
3. One second after the power outage, the transfer switch sends the command to the generator set to start.
4. The generator set starts and provides voltage to the transfer switch, but the transfer switch does not switch (allowing the voltage to go to the building) until after a delay.

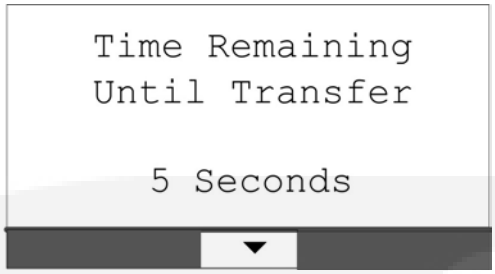


FIGURE 3. TIME REMAINING UNTIL TRANSFER SCREEN

5. Five seconds after starting, the generator set provides a signal to the transfer switch to transfer the building load to the generator set.

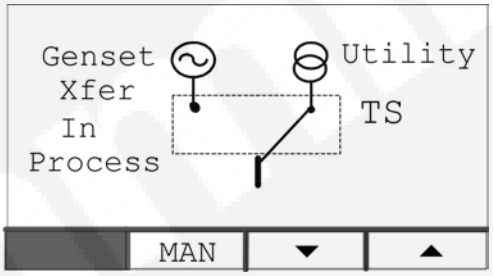


FIGURE 4. BUILDING LOAD TRANSFER IN PROCESS

6. The transfer switch switches the generator set power to the building load. The building is now running on generator power.

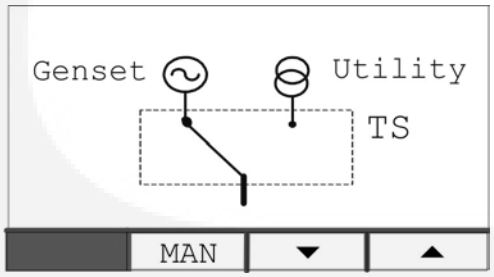


FIGURE 5. GENERATOR SET POWERING BUILDING LOAD

7. When the utility power is back and providing voltage to the transfer switch, the transfer switch waits for utility power stability.

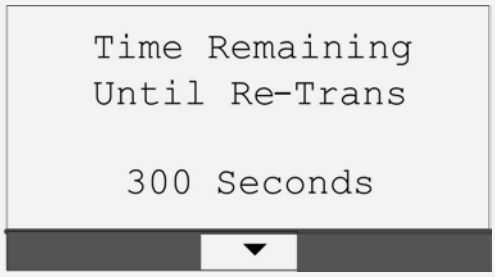


FIGURE 6. TIME REMAINING UNTIL TRANSFER

8. When the utility power is stable for 5 minutes, the transfer switch switches back to utility power.

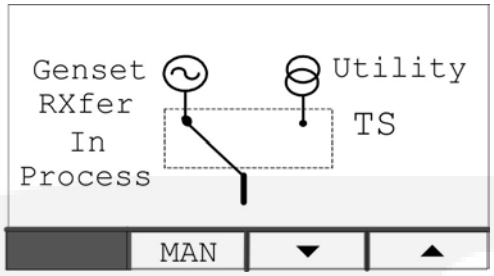


FIGURE 7. BUILDING LOAD TRANSFER IN PROCESS

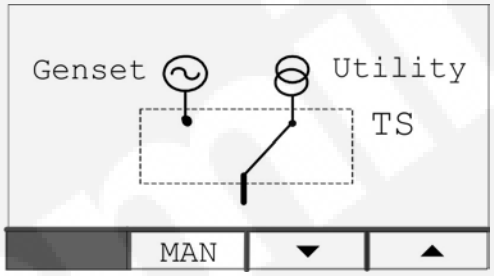


FIGURE 8. UTILITY POWERING BUILDING LOAD

9. The generator set runs for a 5-minute cooldown and shuts off.

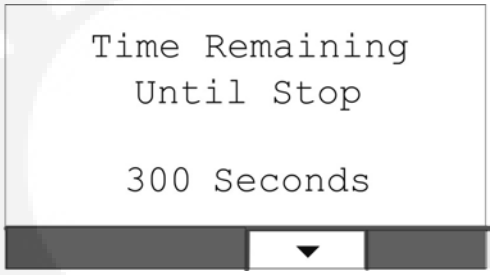


FIGURE 9. TIME REMAINING UNTIL STOP

10. Normal operation resumes.

Exercise Sequence

The exercise sequence when the programmed exercise time is realized (the generator set is in Auto Mode) is as follows:

1. The generator set starts and runs.
2. The Exerciser Scheduler On screen displays every 3 seconds and toggles between the existing Information screen that is displayed for 1 second.

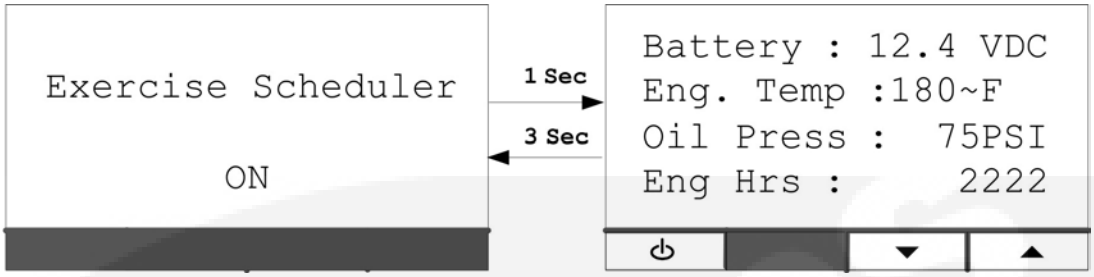


FIGURE 10. EXERCISER SCHEDULER SCREEN AND INFORMATION SCREEN TOGGLE - EXAMPLE

3. The transfer switch is not commanded to switch the building load to the generator set.

NOTICE
The user may navigate to other screens from the Information screens during this duration. No functional keys are active on the Exerciser Scheduler On screen.

4. The generator set stops after programmed exercise run time.

Manually Starting the Generator Set Sequence

The sequence if the generator set is manually started with the standard operator panel, HMI211 (the generator set is in Man Mode), is as follows:

NOTICE
Open the generator set main line circuit breaker to prevent the transfer switch from transferring building load to the generator set.

1. In normal operation, the utility power is running to the transfer switch and then to the building load, and the generator set is off.
2. Manually start the generator set via the standard control (HMI211) mounted on the generator set.

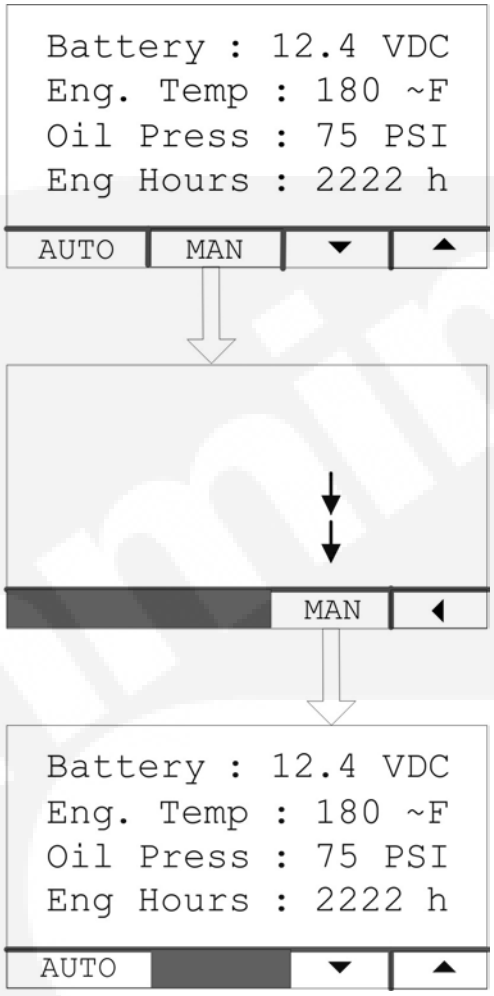


FIGURE 11. MANUAL START SCREEN, STANDARD OPERATOR PANEL

3. The generator set starts and provides voltage to the transfer switch.
4. The generator set provides a signal to the transfer switch to transfer the building load to the generator set.

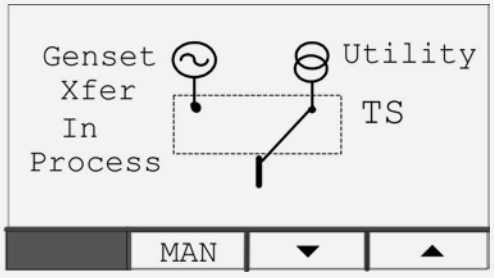


FIGURE 12. BUILDING LOAD TRANSFER IN PROCESS

5. The transfer switch switches the generator set power to the building load. The building is now running on generator power.

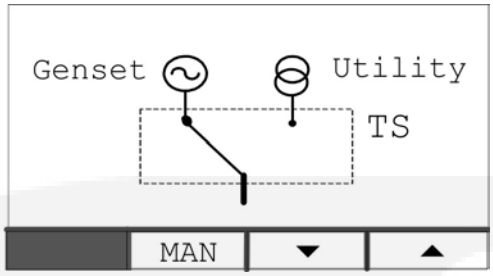


FIGURE 13. GENERATOR SET POWERING BUILDING LOAD

6. Press the Off Mode fixed action button to switch the load back to the utility power.

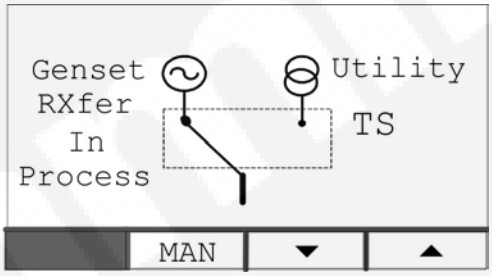


FIGURE 14. BUILDING LOAD TRANSFER IN PROCESS

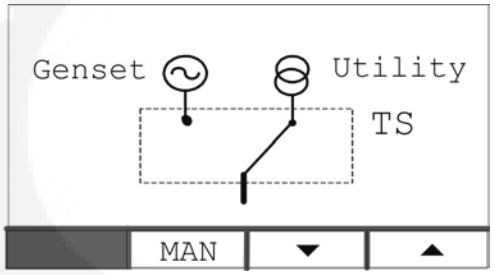


FIGURE 15. UTILITY POWERING BUILDING LOAD

7. Normal operation resumes.

Remote Starting the Generator Set Sequence

The sequence if the generator set is remote started with the in-home operator panel accessory, if equipped (the generator set is in Auto Mode), is as follows:

1. In a normal operation, the utility power is running to the transfer switch and then to the building load, and the generator set is off.
2. The generator set-mounted control (HMI211) is set in Auto Mode.

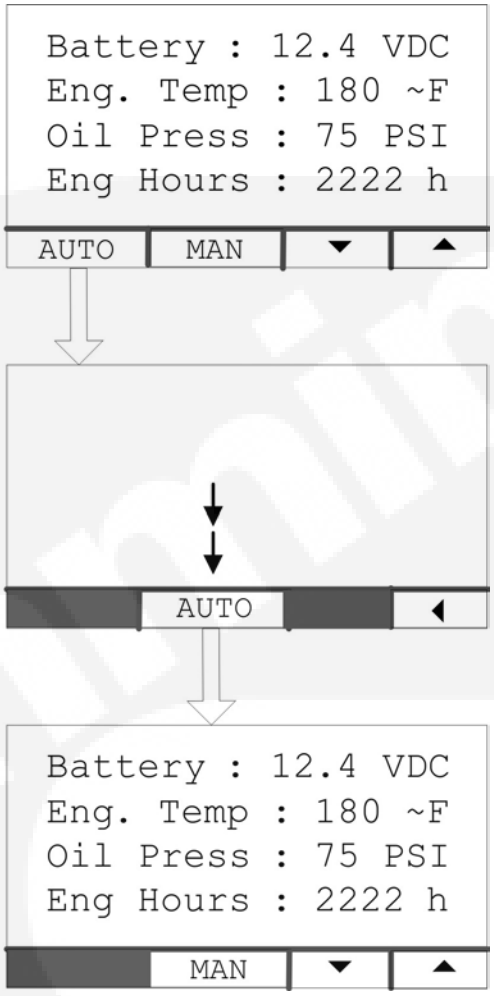


FIGURE 16. HMI211 SET IN AUTO MODE

3. Manually start the generator set via the in-home operator panel.

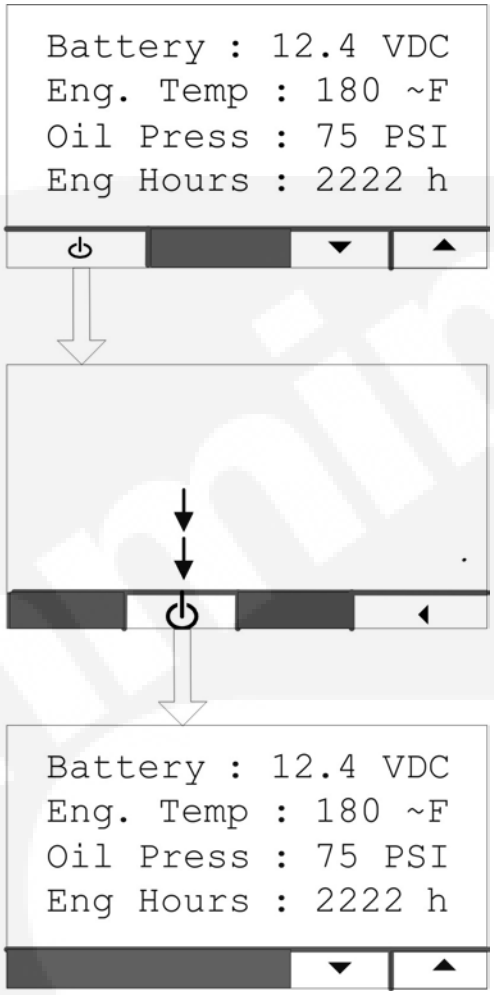

Battery : 12.4 VDC
Eng. Temp : 180 ~F
Oil Press : 75 PSI
Eng Hours : 2222 h
Battery : 12.4 VDC
Eng. Temp : 180 ~F
Oil Press : 75 PSI
Eng Hours : 2222 h

FIGURE 17. MANUAL START SCREEN, IN-HOME OPERATOR PANEL

4. The generator set starts and provides voltage to the transfer switch, but the transfer switch does not switch (allowing the voltage to go to the building) until after a delay.

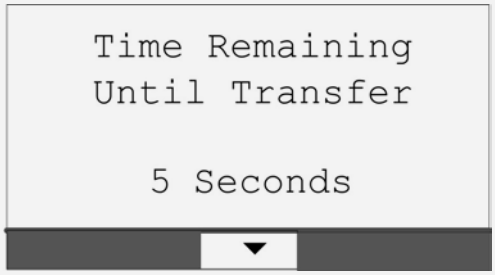


FIGURE 18. TIME REMAINING UNTIL TRANSFER SCREEN

5. Five seconds after starting, the generator set provides a signal to the transfer switch to transfer the building load to the generator set.

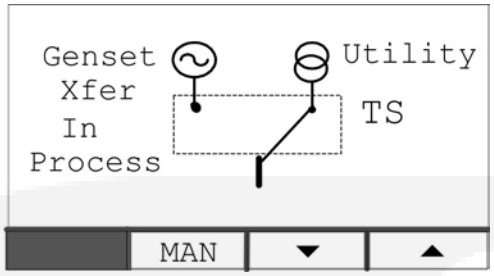


FIGURE 19. BUILDING LOAD TRANSFER IN PROCESS

6. The transfer switch switches the generator set power to the building load. The building is now running on generator power.

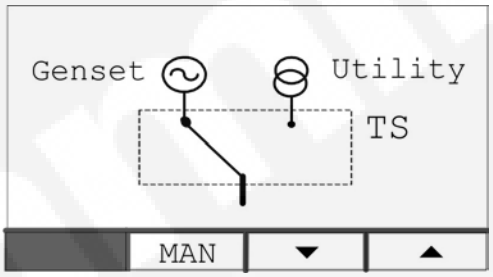


FIGURE 20. GENERATOR SET POWERING BUILDING LOAD

7. When the Stop button is pressed, the transfer switch switches back to utility power.

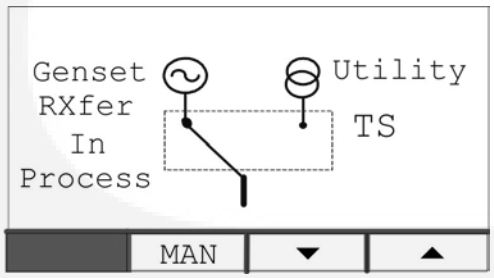


FIGURE 21. BUILDING LOAD TRANSFER IN PROCESS

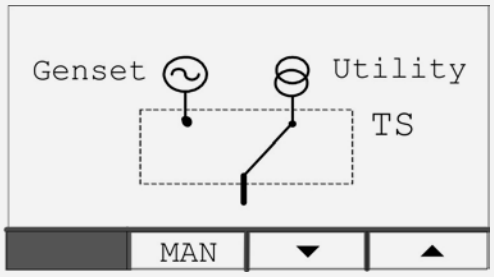


FIGURE 22. UTILITY POWERING BUILDING LOAD

8. The generator set runs for a 5-minute cooldown and shuts off.

FIGURE 23. TIME REMAINING UNTIL STOP

9. Normal operation resumes.

3.4 Operating Modes

The generator set control works with a Manual Run/Off/Auto switch, used to control generator set operating modes.

Off Mode

When in Off mode, the control does not allow the generator set to start. If the generator set is already running and the control is set to Off, it initiates a normal shutdown sequence.

Manual Run Mode

When in Manual Run mode, the generator set starts and continues to run until the control is put into the Off mode. While in Manual Run mode, the remote start signal is ignored.

Auto Mode

When in Auto mode, the control allows the generator set to be started with a remote start signal only.

When in Auto mode, the generator set can start at any time. When a remote start signal is received, the genset starts after a time delay preheat (if programmed) and time delay start (if programmed) is completed.

If the generator set is running in Auto mode and the Off button is pressed, the control immediately stops the genset and the control transitions to the Off mode.

When all remote start signals are removed, the control performs a normal shutdown sequence which may include a time delay stop.

3.5 Brightness and Contrast

The Screen Adjust Menu allows the contrast, brightness, and units to be set. To access the Screen Adjust Menu:

1. From any Information screen, hold down the up and down arrows simultaneously for two seconds to gain access to the Service Menu screen.
2. Select **Screen Adjust**.

To adjust the contrast, brightness, or units from the Screen Adjust screen:

1. From the Screen Adjust Menu, select **Adjust** to access the screen variables.
2. Press the right arrow to move between the variables.
3. Adjust settings, and press **Save** to save any changes.

When updating these settings, the function of the keys are as follows:

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Select the left arrow to return to the previous screen.
- Adjust values by using the + or - keys on the Adjust Menu of the Display Setup Menu.
- Press **Save** to save any changes. After savings, the Save button changes to the Adjust button.

NOTICE
The following screens represent the standard operator panel (HMI211). If using an in-home operator panel, which may be additionally purchased as an option, the screens may look slightly different. This procedure applies to both operator panels.

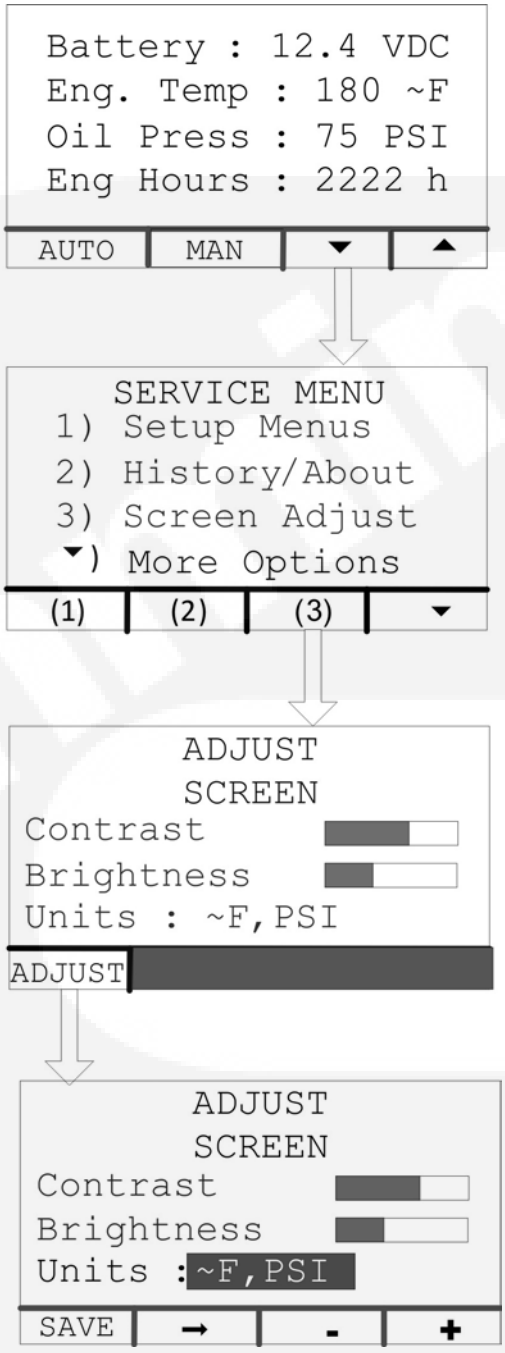


FIGURE 24. BRIGHTNESS AND CONTRAST MENU NAVIGATION

NOTICE
Adjusting the brightness on the Operator Panel adjusts the brightness of both the LCD backlight and the LEDs on the display. The contrast should never be 0 or 100% on any of the screens. The default value for Brightness is 50%.

3.6 History and About Menu

To access the History/About Menu:

1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
2. Select **History/About**.
3. Advance through the screens to view information about the generator set, control, and display.

NOTICE
The following screens represent the standard operator panel (HMI211). If using an in-home operator panel, which may be additionally purchased as an option, the screens may look slightly different. This procedure applies to both operator panels.

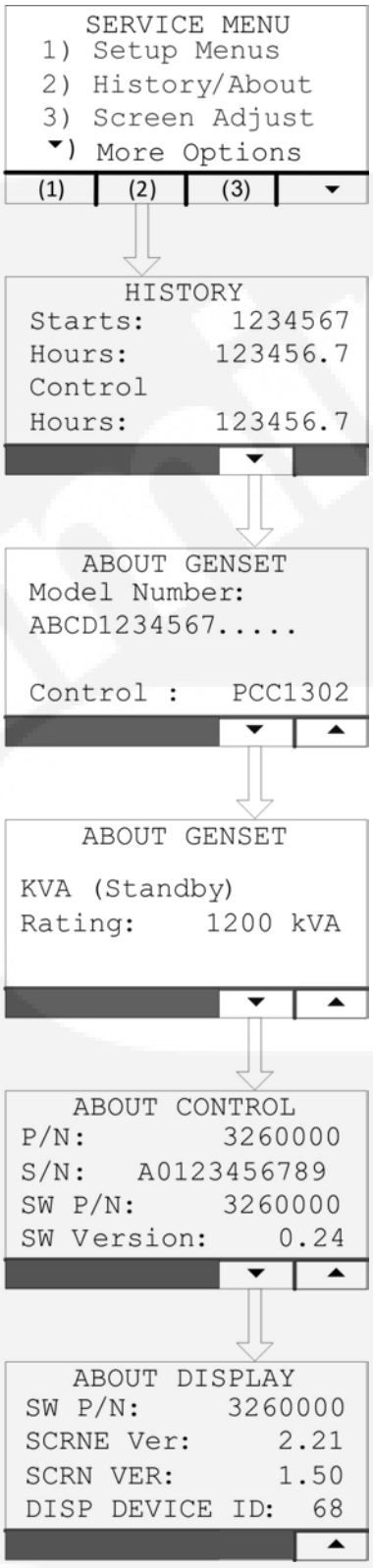


FIGURE 25. HISTORY/ABOUT MENU

3.7 Fault Log

To check the fault log:

1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
2. Select **Fault History**.

NOTICE
The active faults are displayed first. If there are no active faults, this screen is skipped. Following the Active Faults Menu are the Fault History screens. These screens display the faults in chronological order from newest to oldest.

NOTICE
The following screens represent the standard operator panel (HMI211). If using an in-home operator panel, which may be additionally purchased as an option, the screens may look slightly different. This procedure applies to both operator panels.

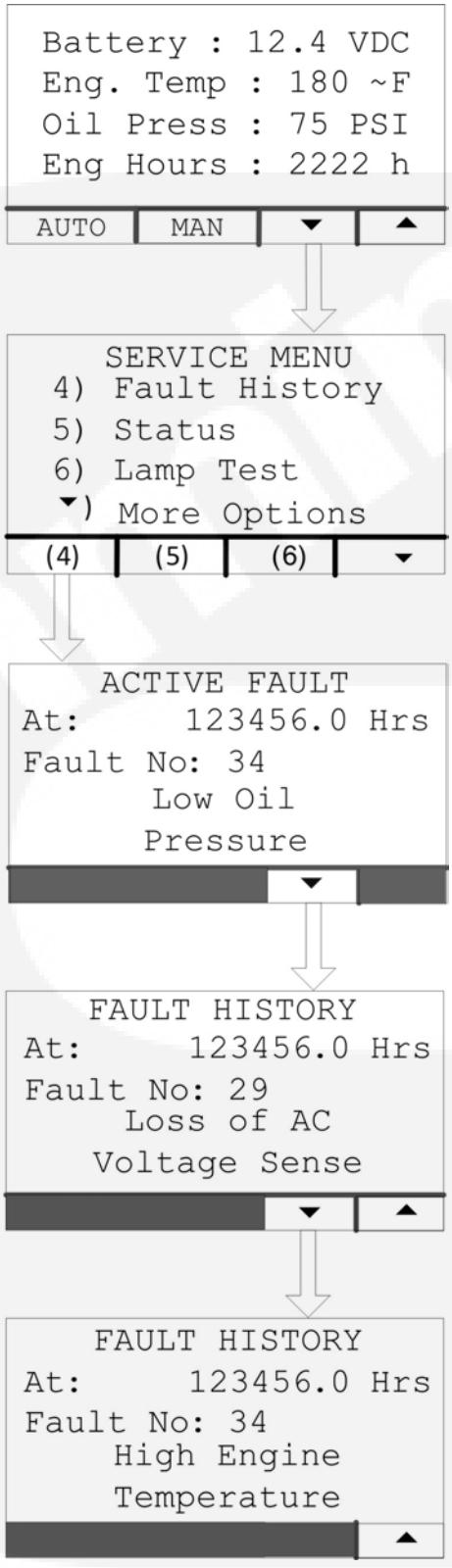


FIGURE 26. FAULT LOG SCREEN

3.8 Time Setup

NOTICE
When battery power is lost, these settings must be reset.

To set up the generator set clock for the current date and time:

1. Access the Time Setup Menu by selecting **Clock Exerciser** on the Genset Service Menu.
2. Select **Adjust**.

When updating these settings, the function of the keys are as follows:

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Select the left arrow to return to the previous screen.
- Adjust values by using the + or - keys on the Adjust Menu of the Time Setup Menu.
- Press **Save** to save any changes. After savings, the Save button changes to the Adjust button.

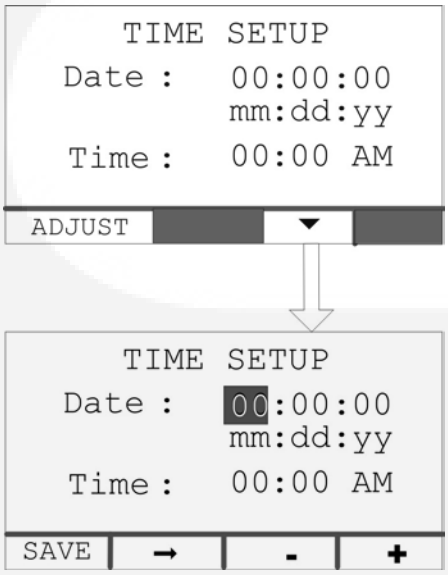


FIGURE 27. TIME SETUP SCREEN

Updating Daylight Saving Adjust Menu

To update the Savings Time and Adjustment on the Daylight Saving Adjust Menu:

1. Press the down key on the Time Setup Menu to access the Daylight Saving Adjust Menu.
2. Select **Adjust**.

When updating these settings, the functions of the keys are as follows:

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Select the left arrow to return to the previous screen.
- Adjust values by using the + or - keys on the Adjust Menu of the Daylight Saving Adjust Menu.
- Press **Save** to save any changes. After savings, the Save button changes to the Adjust button.

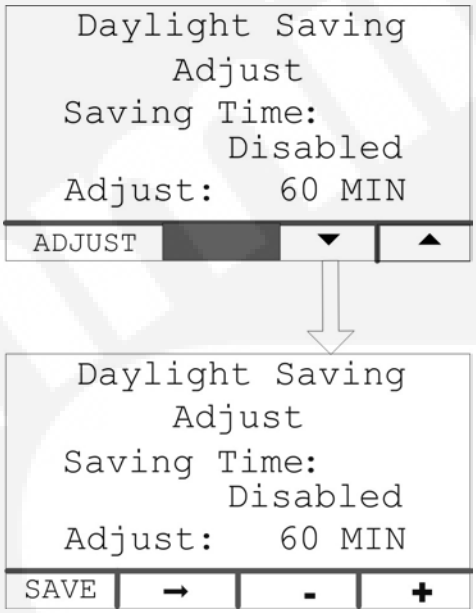


FIGURE 28. DAYLIGHT SAVING ADJUST MENU NAVIGATION

To access and update the Daylight Saving Adjust Start Menu:

1. Press the down key on the Daylight Saving Adjust Menu.
2. Press **Adjust**.

When updating these settings, the functions of the keys are as follows:

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Use the + or - keys to edit the following settings:
  - Month
  - Week
  - Day
  - Hour
- Press **Save** to save any changes. After savings, the Save button changes to the Adjust button.

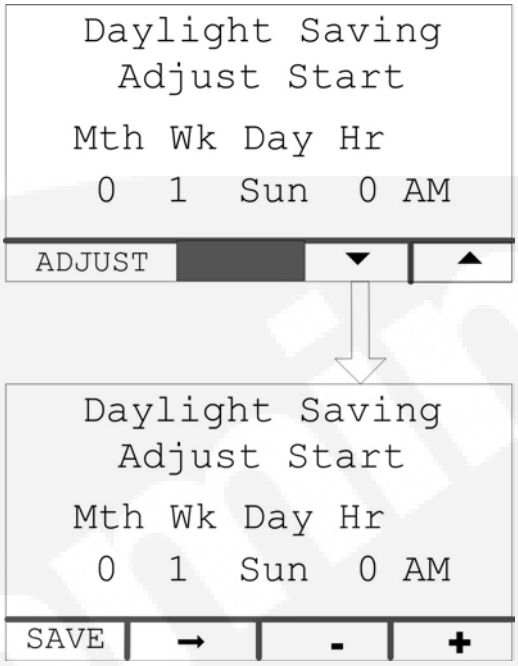


FIGURE 29. DAYLIGHT SAVING ADJUST START MENU

To access and update the Daylight Saving Adjust End Menu:

1. Press the down key on the Daylight Saving Adjust Start Menu.
2. Press **Adjust**.

When updating these settings, the functions of the keys are as follows:

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Use the + or - keys to edit the following settings:
  - Month
  - Week
  - Day
  - Hour
- Press **Save** to save any changes. After savings, the Save button changes to the Adjust button.

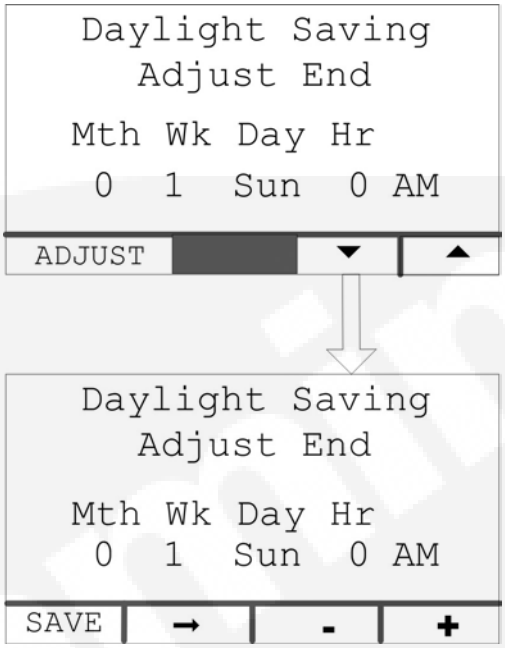


FIGURE 30. DAYLIGHT SAVING ADJUST END MENU

3.9 Exercise Settings

NOTICE
When the battery power is lost, these settings must be reset.

To access the Clock/Exerciser Menu:

1. From any Information Menu, hold down the up and down arrows simultaneously for two seconds. The Service Menu appears.
2. Navigate through the screens to find and select **Clock/Excr** in the Service Menu.

NOTICE
The following screens represent the standard operator panel (HMI211). If using an in-home operator panel, which may be additionally purchased as an option, the screens may look slightly different. This procedure applies to both operator panels.

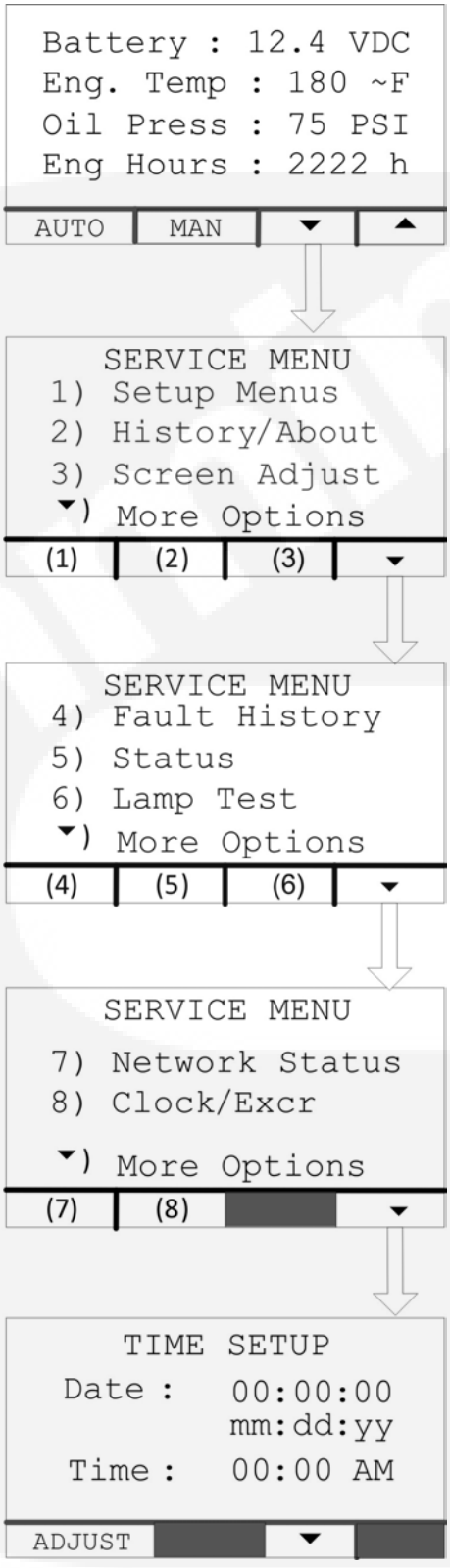


FIGURE 31. CLOCK/EXERCISER MENU NAVIGATION

Updating Exercise Frequency

To update the exercise frequency and dates on the Clock/Exerciser Menu:

1. Press **Exercise Schdr** on the Daylight Saving Adjust End Menu.
2. Press **Adjust**.

When updating these settings, the functions of the keys are as follows:

- The horizontal right arrow key is used to select successive blocks for editing settings on the screen.
- Use the + or - keys to edit the following settings:
  - Schdr Enable: Enable or Disable
  - Exercise Schedule: Semi-Annual (every six months), Quarterly, Monthly, Bi-Weekly (every two weeks) , or Weekly
  - Exercise Schedule: Day, Hours, Minutes, AM/PM
- Press **Save** to save any changes. After savings, the Save button changes to the Adjust button.

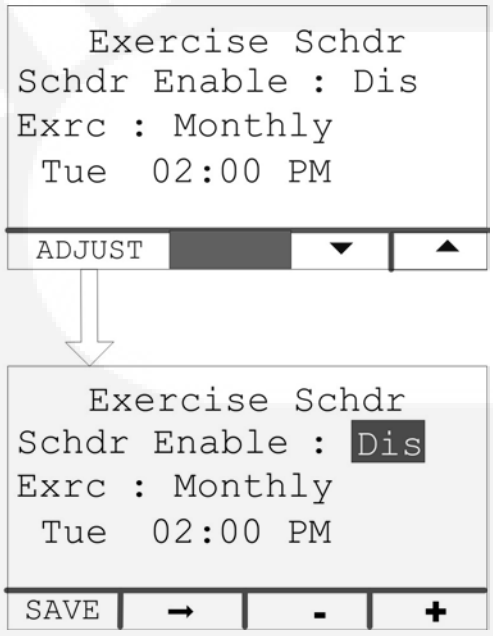


FIGURE 32. EXERCISE FREQUENCY NAVIGATION

Updating Exercise Duration

To update the exercise duration on the Clock/Exerciser Menu:

1. Press the down key on the Exercise Schdr Menu.
2. Press **Adjust**.

When updating these settings, the functions of the keys are as follows:

- The horizontal right arrow key is used to select the duration block for editing exercise duration.

- Use the + or - keys to edit the exercise duration minutes.
- Press **Save** to save any changes. After savings, the Save button changes to the Adjust button.

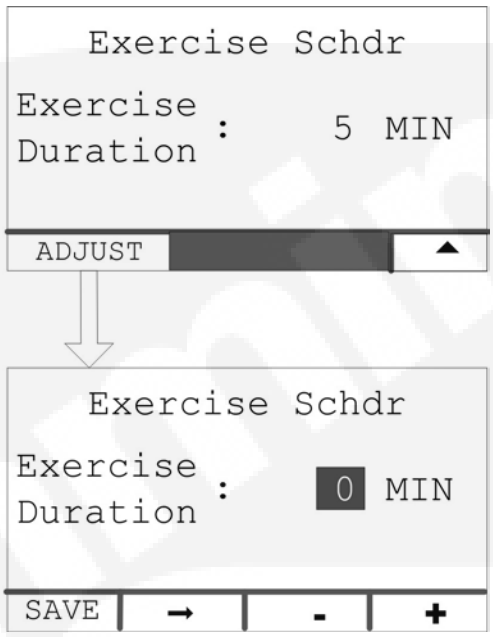


FIGURE 33. EXERCISE DURATION NAVIGATION

4 Maintenance

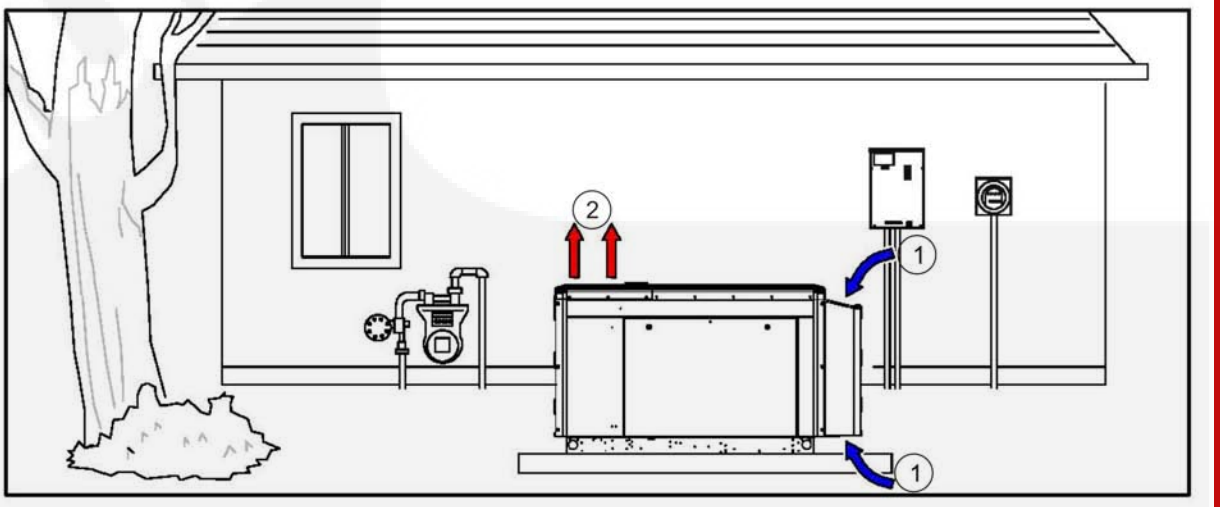
Regularly performing the following periodic maintenance and guidelines greatly reduce the chances of a generator set shutdown.

- Maintain an appropriate oil level
- Keep battery connections clean and tight
- Do not overload the generator set
- Keep the air inlet and outlet openings clear

4.1 General Operating Conditions

The area surrounding the generator set is critical for safety and its performance. Follow the guidelines below.

- Do not stack anything on top of the generator set.
- Do not store anything inside of the generator set.
- Keep areas clear in front of the cool air in and hot air out (free of obstructions, debris, plants, etc.).



No.	Description	No.	Description
1	Cool Air In	2	Hot Air Out

FIGURE 34. GENERATOR SET LOCATION

NOTICE
All maintenance procedures must be performed or supervised by authorized and trained service personnel only.

4.2 Periodic Maintenance

The periodic maintenance procedures should be performed at whichever interval occurs first (calendar time or hours of operation). At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

The tabular data that follows gives the recommended service intervals for a generator set on Standby service. If the generator set will be subjected to extreme operating conditions, the service intervals should be reduced accordingly.

Some of the factors that can affect the maintenance schedule are:

- Extremes in ambient temperature
- Exposure to elements
- Exposure to salt water
- Exposure to windblown dust or sand.

Consult with an authorized dealer if the generator set will be subjected to any extreme operating conditions and determine if extra protection or a reduction in service intervals is needed. Use the running time meter to keep an accurate log of all service performed for warranty support. Perform all service at the time period indicated, or after the number of operating hours indicated, whichever comes first.

⚠ WARNING

Accidental or remote starting of the generator set can cause severe personal injury or death. Before working on the generator set, make sure that the generator set is in Off mode, disable the battery charger, and remove the negative (–) battery cable from the battery to prevent starting.

Periodic Maintenance Schedule

TABLE 18. AIR INTAKE MAINTENANCE

MAINTENANCE ITEMS Perform maintenance tasks as specified using Daily or Hourly periods of operation - whichever occurs first	Daily or After 24 Hours	100 Hours
Check air cleaner restriction indicator (where fitted): If the service indicator shows red, replace air cleaner elements and reset the air cleaner service indicator.	■	
Check air intake system for leaks: Visually inspect the air intake system for signs of wear or damage. Check audibly when the generator set is running. Replace worn or damaged components.	■	
Replace air cleaner.		■

TABLE 19. CONTROL MAINTENANCE

MAINTENANCE ITEMS Perform maintenance tasks as specified using Daily or Hourly periods of operation – whichever occurs first	Daily or After 24 Hours	Weekly or After 50 Hours
Check operation of operator panel: Check display (the system will perform a control panel test on initial activation). Replace component if not functioning properly.	■	
Check operation of Emergency Stop Button (where fitted): With the generator set running, press the **Emergency Stop** button. Check all systems, before resetting the fault.		■

TABLE 20. COOLING MAINTENANCE

MAINTENANCE ITEMS Perform maintenance tasks as specified using Daily or Hourly periods of operation – whichever occurs first	Daily or After 24 Hours	Weekly or After 50 Hours	12 Months or After 200 Hours	2 Years
Check coolant level of radiator(s) (water jacket & LTA): If low, top up to coolant system specifications level, with Cummins recommended coolant mix.	■			
Check cooling fan blades: Visually inspect the fan blades through the guarding for signs of wear or damage.	■			
Check drive belt, condition and tension: Visually check belt for evidence of wear or slippage.	■			
Check coolant lines and radiator hoses for leaks, wear, and cracks: Visually check for leaks, worn or damaged hoses.	■		■	
Check radiator air flow: Visually inspect the radiator through the guarding for blockage, build up of debris, signs of wear or damage.	■			
Clean radiator core.			■[1]	
Check aftercooler core (where fitted).			■	
Check water pump.			■	
Check coolant heater has power and is running (where fitted).	■			
Replace cooling system coolant.				■
■[1] – Cleaning schedule may be reduced depending on operating conditions/environment.				

TABLE 21. ENGINE MAINTENANCE

MAINTENANCE ITEMS Perform maintenance tasks as specified using Daily or Hourly periods of operation – whichever occurs first	Daily or After 24 Hours	Weekly or After 50 Hours	12 Months or After 200 Hours
Check engine oil level: If low, top up to engine specifications level, with recommended oil.	■		
Check fuel lines and hoses: Visually check for leaks, worn or damaged hoses.	■		
Check charge alternator: Check visually and audibly when the generator set is running.	■		
Replace engine oil and filters.		■[1]	■[1]
Check engine ground. Clean as necessary.			■
Check engine mounts.			■
Check starting motor.			■
Check turbocharger (where fitted).			■
Check timing belt condition. Visually inspect.			■
Inspect spark plugs. Replace as necessary.			■
■[1] – After the inital 50 hour interval and every 200 hours thereafter.			

TABLE 22. EXHAUST MAINTENANCE

MAINTENANCE ITEMS Perform maintenance tasks as specified using Daily or Hourly periods of operation – whichever occurs first	Daily 24 or After Hours	Weekly or After 50 Hours
Check all exhaust components, and hardware (fittings, clamps, fasteners, etc.): Visually inspect the exhaust system for signs of wear or damage. Check audibly when the generator set is running.	■	

TABLE 23. GENERATOR SET MAINTENANCE

MAINTENANCE ITEMS Perform maintenance tasks as specified using Daily or Hourly periods of operation – whichever occurs first	Daily or After 24 Hours	Weekly or After 50 Hours	12 Months or After 200 Hours
Check generator set enclosure: Visually check enclosure, walk around inspection of generator set. Make sure no inlets/outlets are covered/restricted, service access doors are operational and safety systems are in place and operational.	■		
Check batteries: Check connections are secure and battery area is free from tools and other items.		■	■
Check battery condition.			■
Check electrical connections (battery, starter motor and alternator connections).			■

4.3 Exercising the Generator Set

NOTICE
Audible engine RPM variation may be heard when there is no load applied. This is normal and does not affect the generator set performance.

Exercising the generator set drives off moisture, relubricates the engine and removes oxides from electrical contacts. The result is better starting, more reliable operation and longer engine life.

The generator set exerciser mode defaults are as follows.

- Day: Tuesday
- Time: 2:00 pm
- Period: Monthly
- Run Time: 5 minutes

Refer to the **Exercise Settings** section of this manual for more information on setting up the exerciser.

4.4 Engine Oil Maintenance

Recommended Engine Oil

Check the oil level prior to starting the generator set to verify that the oil level is between the High and Low marks. The generator set is shipped with engine oil (5W30 API SM engine oil is recommended).

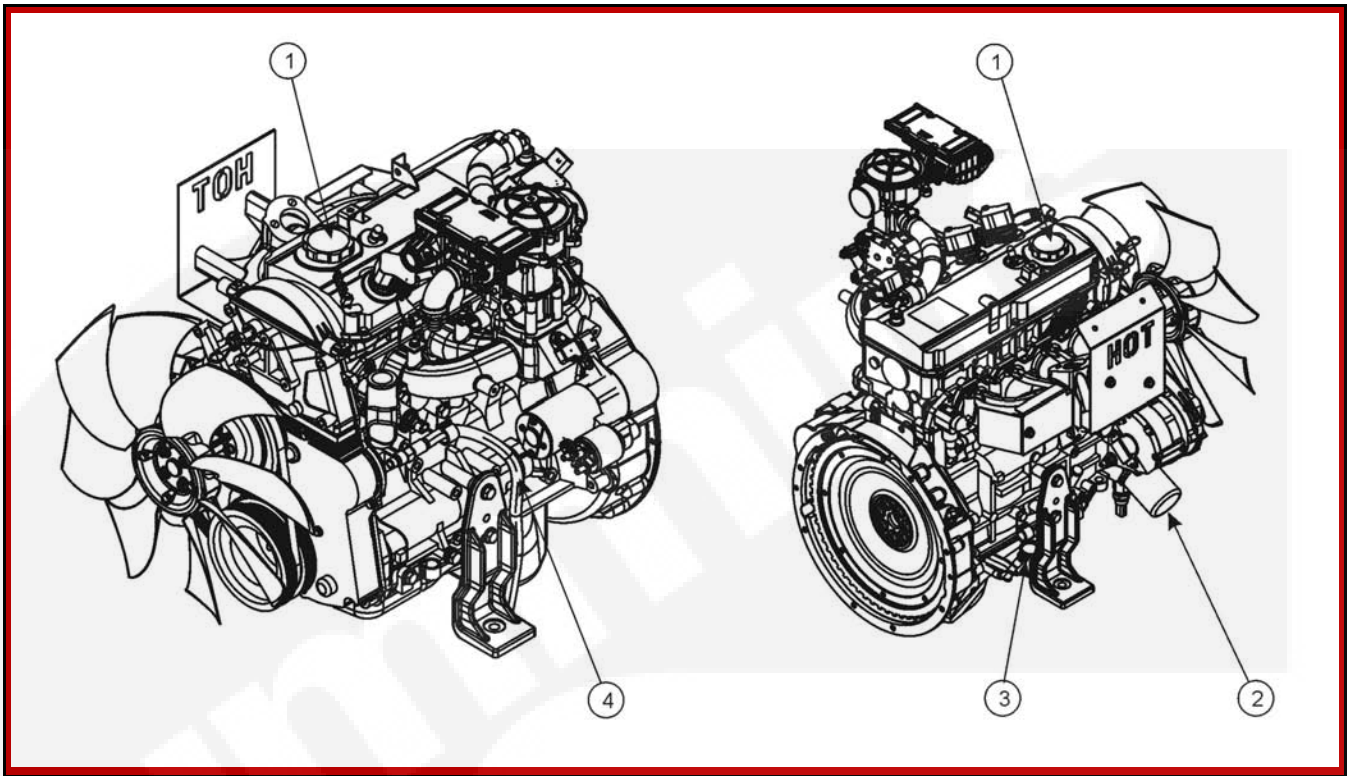
Checking Engine Oil Level

NOTICE
Check the engine oil level when the engine is not running and is out of Auto mode.

⚠ WARNING
Crankcase pressure can blow out hot oil and cause severe burns. Do NOT check oil while the engine is operating.

⚠ CAUTION
Overfilling can cause foaming or aeration of the oil while operation below the low mark may cause loss of oil pressure. Do not operate the engine with the oil level below the low mark or above the high mark.

⚠ WARNING
State and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin. Accidental or remote starting of the generator set can cause severe personal injury or death. Disconnect the negative (-) battery cable and place the control switch in its OFF position before starting work.



No.	Description	No.	Description
1	Fill Cap	3	Dipstick
2	Oil Filter	4	Oil Drain Hose

FIGURE 35. ENGINE OIL COMPONENTS

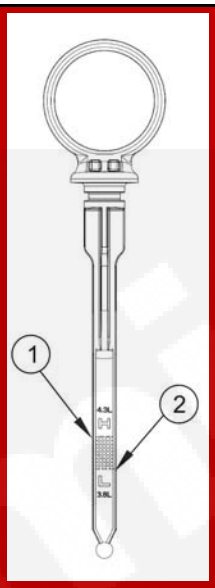
To check the engine oil level:

1. Pull out the dipstick and wipe it clean.
2. Clean off the area surrounding the dipstick port to prevent entry of debris into the oil pan.
3. Make sure that the engine has not been running for approximately five minutes.
4. Reinsert and fully seat the dipstick.
5. Remove the dipstick and check the oil level.

NOTICE

The engine oil level indicated on the dipstick should be between the High (4.3 L or 4.5 qt) and Low (3.8 L or 4.0 qt) marks.

6. Reinsert and fully seat the dipstick.



No.	Description	No.	Description
1	High Oil Level (4.3 L or 4.5 qt)	2	Low Oil Level (3.8 L or 4.0 qt)

FIGURE 36. ENGINE OIL DIPSTICK

If the engine oil level check shows excessive or insufficient levels of oil (oil level line above the High mark or below the Low mark), oil must be drained or added. Refer to the following sections for instructions and guidelines for draining and adding oil.

Adding or Draining Oil

⚠ CAUTION

Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the High and Low marks on the dipstick.

⚠ CAUTION

Hot engines can burn you. Ensure that the generator set engine has cooled down before adding or draining the oil.

Adding Oil

If the oil level is found to be insufficient, oil must be added.

1. Ensure that the oil fill cap area is clean, and prevent debris from entering the engine.
2. Add the appropriate amount of oil, based on the engine oil level check performed beforehand.
3. Recheck the engine oil level. Based on the results, add or drain oil.

4. Clean up and dispose of any oil in accordance with local/state regulations.

Draining Oil

If the oil level is found to be excessive, oil must be drained from the engine.

1. Detach the oil drain hose from the side of the engine.
2. Place the end of the drain hose into an appropriate container.

Refer to local regulations to determine the appropriate container for used oil.

- Open the oil drain valve to release oil from the engine into the appropriate container.
- Recheck the engine oil level. Based on the results, add or drain oil.
- When a sufficient amount of oil has been drained from the system:
  1. Close the oil drain valve.
  2. Wipe the oil drain valve clean.
  3. Re-attach the drain hose to the side of the engine.
  4. Dispose of the used oil in accordance with local/state regulations.

Changing Engine Oil and Oil Filter

Change the oil more often in hot and dusty environments.

⚠ WARNING

Some state and federal agencies have determined that used engine oil can be carcinogenic and cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil. If not reused, dispose of in accordance with local environmental regulations.

⚠ WARNING

To reduce the possibility of personal injury, avoid direct contact of hot oil with your skin.

NOTICE

Change the engine oil and filter when the engine is not running and is out of Auto mode.

1. Before changing the oil, the engine should be operated until the water temperature is approximately 60 °C (140 °F).
2. Shut down the engine.
3. Drain the oil.
4. Remove the oil filter, and clean the filter mounting surface on the engine block. Remove the old gasket if it remains.

5. Make sure the gasket is in place on the new filter and apply a thin film of clean oil to the gasket. Install the new filter until the gasket just touches the block. Turn it an additional 1/2 to 3/4 turn. Do not over tighten.
6. Refill with oil until full.

⚠ CAUTION
Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the High and Low marks.

7. Start and run for 30 seconds.
8. Shut the engine off and wait 5 minutes.
9. Check the engine oil level.
10. Dispose of the used oil and oil filter according to local environmental regulations.

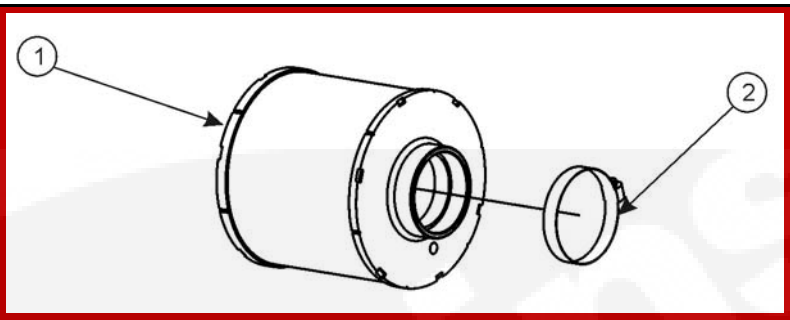
4.5 Air Intake System

Normal Duty Air Cleaner

Air Cleaner Removal

⚠ CAUTION
Holes, loose-end seals, dented sealing surfaces, corrosion of pipes, and other forms of damage render the air cleaner inoperative and require immediate element replacement or engine damage can occur.

NOTICE
Cummins Inc. does not recommend cleaning paper-type air cleaner elements.

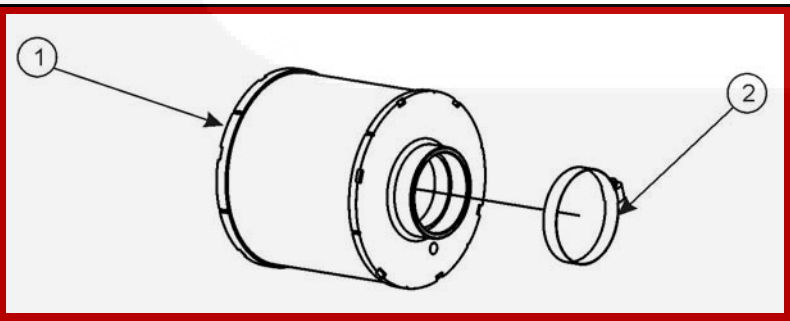


No.	Description	No.	Description
1	Air cleaner	2	Strap clamp

FIGURE 37. NORMAL DUTY AIR CLEANER

1. Loosen the strap clamp (2).
2. Wipe away any debris accumulated around the air cleaner connection to the engine. Ensure that no debris is allowed to enter the body of the air cleaner or the connection on the engine.
3. Remove the dirty cleaner (1). Dispose of the dirty element in accordance with local environmental agency requirements.

Air Cleaner Installation



No.	Description	No.	Description
1	Air cleaner	2	Strap clamp

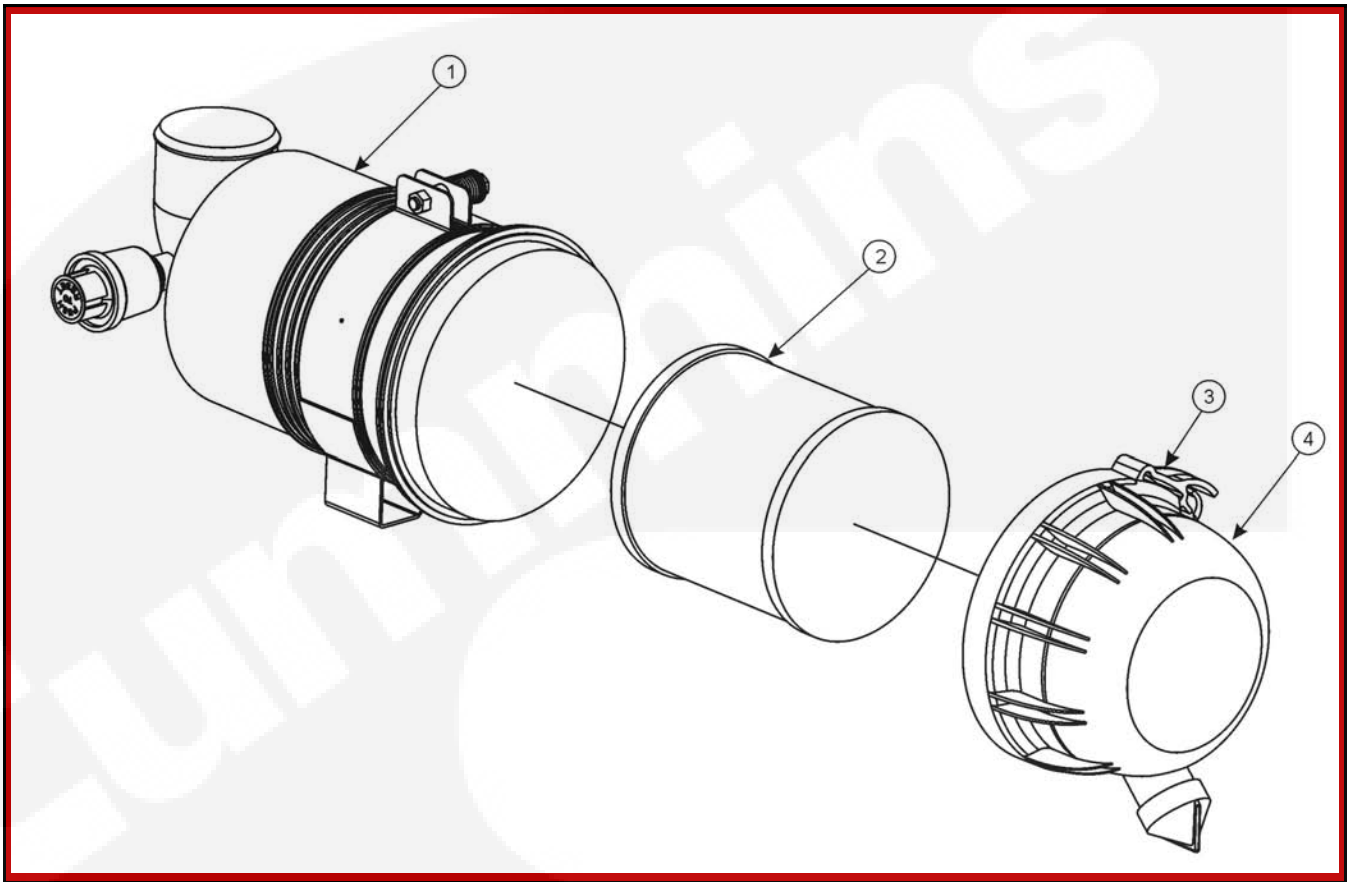
FIGURE 38. NORMAL DUTY AIR CLEANER

Install the air cleaner (1) as follows:

1. Install the air cleaner (1).
2. Tighten strap clamp (2).

Heavy Duty Air Cleaner

Air Cleaner Element Removal



No.	Description	No.	Description
1	Housing	3	Latch
2	Media	4	End cover

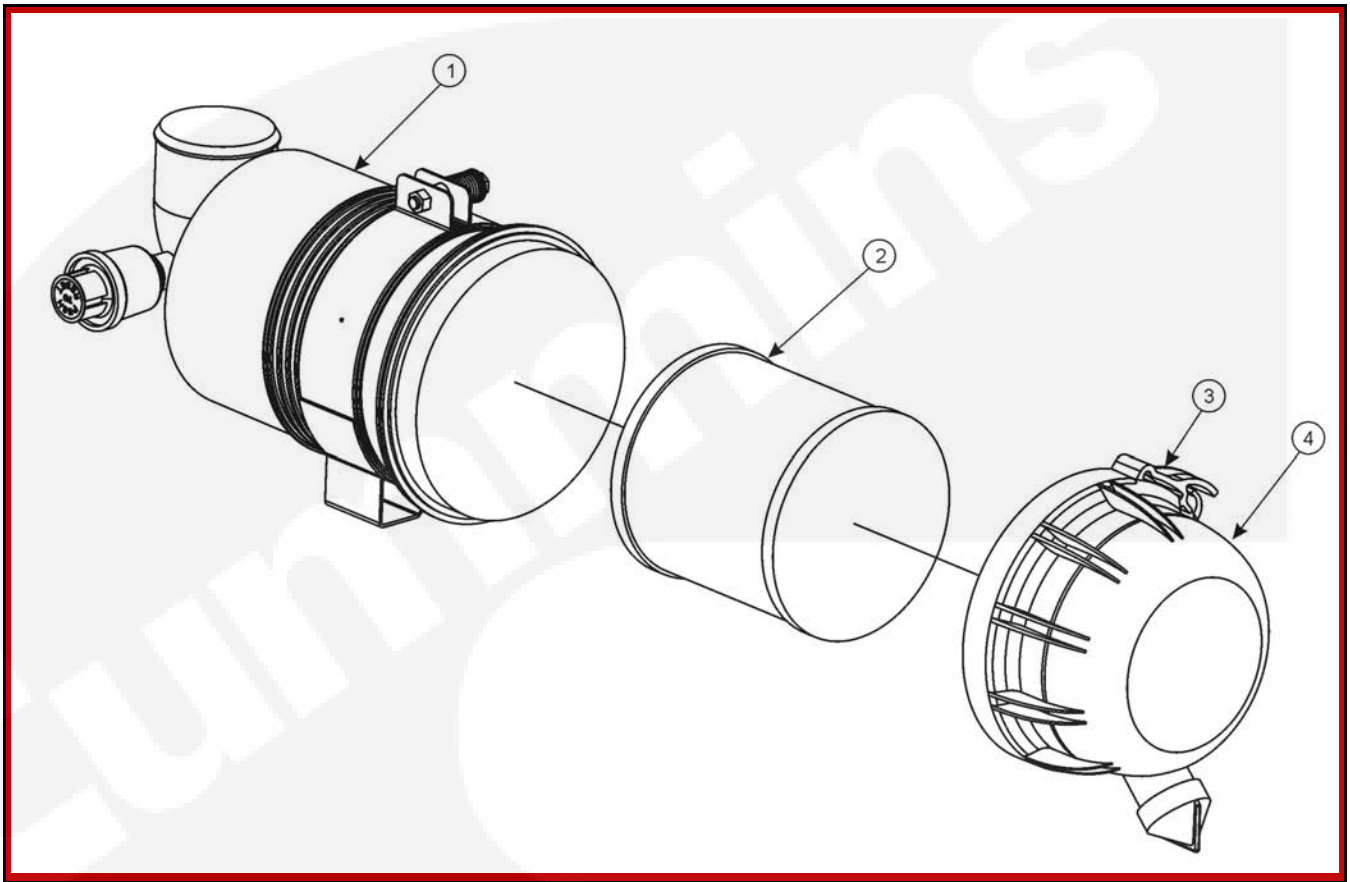
FIGURE 39. HEAVY DUTY AIR CLEANER

NOTICE
Cummins Inc. does not recommend cleaning paper-type air cleaner elements.

1. Before disassembly, wipe dirt from the cover and the upper portion of the air cleaner.
2. Lift tab (3) and turn end cover (4) counter clockwise.
3. Pull the end cover (4) away from the housing (1).

4. Remove the media (2) from the housing (1).

Air Cleaner Element Installation



No.	Description	No.	Description
1	Housing	3	Latch
2	Media	4	End cover

FIGURE 40. HEAVY DUTY AIR CLEANER

1. Ensure that no debris enters the filter element or connection point on the air cleaner housing.
2. Insert the media (2) into the housing (1).
3. Install the end cover (4) onto the housing (1).
4. Turn the end cover (4) clockwise until latch (3) snaps into place.

4.6 Battery Maintenance

⚠ WARNING

Accidental or remote starting of the generator set can cause severe personal injury or death. Before working on the generator set, make sure that the generator set is in Off mode, disable the battery charger, and remove the negative (–) battery cable from the battery to prevent starting. Arcing at battery terminals or in light switches or other equipment, and flames or sparks, can ignite battery gas causing severe personal injury. Ventilate battery area before working on or near battery. Wear safety glasses. Do not smoke. Switch work light On or Off away from battery. Stop the generator set. Disconnect the negative (-) battery cable first and reconnect it last.

Replace the battery charger if the battery keeps running down.

Always:

- Keep the battery case and terminals clean and dry and the terminals tight.
- Remove battery cables with a battery terminal puller.
- Make sure which terminal is positive (+) and which is negative (-) before making battery connections, always removing the negative (-) cable first and reconnecting it last to reduce arcing.

NOTICE

If the battery needs to be replaced, be sure that the replacement battery specs match those found in the Model Specifications in this manual.

4.7 Spark Plugs

Set the generator set control to the Off position before checking the spark plugs.

The generator set has two spark plugs: one on each side of the engine. The spark plugs must be in good condition for proper engine starting and performance. A spark plug that fouls frequently or has heavy soot deposits indicates the need for engine service.

To prevent cross threading a spark plug, always thread it in by hand until it seats. Torque the spark plug to 15 lb-ft (20 N-m).

Return the generator set control to the desired setting when finished performing maintenance.

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5 Troubleshooting

The following list of codes is not an all inclusive list. For more information about the fault codes listed or for additional codes, contact your local dealer.

NOTICE
Only trained and authorized personnel shall maintain or service the generator set.

5.1 Display Text or Symbolic Version

The operator panel graphical display can be set to show text (English only) or symbols for fault messages, some operator menus, and the Mode Change Menu. Descriptions of commonly used symbols are included in the following table. Combinations of symbols are used to display some fault conditions. Additional specialized symbols are also used for some faults.

When shipped from the factory, the display is set to display symbols. Qualified service personnel are required to change the default setting.

TABLE 24. SYMBOLS

Symbol	Text
	Generator Warning Fault
	Generator Shutdown Fault
	Coolant Temperature
	Oil Pressure
	Voltage Alternating Current (VAC)
	Voltage Direct Current (VDC)
	AC Current
Hz	Frequency
	Battery
	Out of Range
	High or Pre-High

Symbol	Text
	Low or Pre-Low
	Annunciator
	Over Speed
	Crank Fail
	Emergency Stop

5.2 Engine is Difficult to Start or Does Not Start

Possible Cause:

1. Battery voltage
2. Fuel system issue(s)

Diagnosis and Repair:

1. Battery voltage.
   - Battery voltage is low, interrupted, or open.
     - Check the batteries connections, unswitched battery supply circuit, and fuses.
2. Fuel system issue(s).
   - Manual fuel shutoff valve is closed.
     - Check the manual fuel shutoff valves.

5.3 Code 143 - Engine Oil Pressure Low (Warning)

Logic:

Engine oil pressure is below the low oil pressure warning threshold.

Possible Cause:

1. Lubricating oil level is low
2. External leak

Diagnosis and Repair:

1. Lubricating oil level is low.
   a. Check the oil level. Add oil, if necessary.
2. External leak.
   a. Inspect the engine and surrounding area for external oil leaks.
   b. Contact your local dealer if a leak is present.

5.4 Code 146 - Engine Coolant Temperature Above Normal (Warning)

Logic:

Engine coolant temperature has exceeded 225 °F (107.2 °C) for greater than 5 seconds.

Possible Cause:

1. High ambient temperature
2. Enclosure air intake blocked
3. Coolant level is below specification
4. Radiator core fouled
5. Enclosure air discharge blocked
6. Broken fan belt

Diagnosis and Repair:

1. High ambient temperature.
    a. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Enclosure air intake blocked.
    a. Inspect for dirt, debris, or obstructions.
    b. Remove blockage or snow/ice buildup as applicable.
3. Coolant level is below specification.
    a. Check coolant level.
    b. Add coolant as necessary.
4. Radiator core fouled.
    a. Inspect for dirt, debris, or obstruction on core.
    b. Remove obstructions or debris, and clean the radiator core.
5. Enclosure air discharge blocked.
    a. Inspect for dirt, debris, or obstructions.
    b. Remove blockage or snow/ice buildup as applicable.
6. Broken fan belt.
    a. Inspect fan belt.
    b. Replace fan belt.

5.5 Code 151 – Engine Coolant Temperature High (Shutdown)

Logic:

Engine coolant temperature has exceeded the alarm (shutdown) threshold for high coolant temperature.

Possible Cause:

1. High ambient temperature
2. Enclosure air intake blocked
3. Coolant level is below specification
4. Radiator core fouled
5. Enclosure air discharge blocked
6. Broken fan belt
7. Coolant level is below specification

Diagnosis and Repair:

1. High ambient temperature.
    a. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Enclosure air intake blocked.
    a. Inspect for dirt, debris, or obstructions.
    b. Remove blockage or snow/ice buildup as applicable.
3. Coolant level is below specification.
    a. Check coolant level.
    b. Add coolant as necessary.
4. Radiator core fouled.
    a. Inspect for dirt, debris, or obstruction on core.
    b. Remove obstructions or debris, and clean the radiator core.
5. Enclosure air discharge blocked.
    a. Inspect for dirt, debris, or obstructions.
    b. Remove blockage or snow/ice buildup as applicable.
6. Broken fan belt.
    a. Inspect fan belt.
    b. Replace fan belt.
7. Coolant level is below specification.
    a. Check coolant level.

b. Add coolant as necessary.

5.6 Code 155 – Intake Manifold Temperature High (Shutdown)

Logic:

Engine intake manifold temperature has exceeded 203 °F (95 °C) for greater than 10 seconds.

Possible Cause:

1. High ambient temperature
2. Enclosure air intake blocked
3. Coolant level is below specification
4. Radiator core fouled
5. Enclosure air discharge blocked
6. Broken fan belt

Diagnosis and Repair:

1. High ambient temperature.
   a. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Enclosure air intake blocked.
   a. Inspect for dirt, debris, or obstructions.
   b. Remove blockage or snow/ice buildup as applicable.
3. Coolant level is below specification.
   a. Check coolant level.
   b. Add coolant as necessary.
4. Radiator core fouled.
   a. Inspect for dirt, debris, or obstruction on core.
   b. Remove obstructions or debris, and clean the radiator core.
5. Enclosure air discharge blocked.
   a. Inspect for dirt, debris, or obstructions.
   b. Remove blockage or snow/ice buildup as applicable.
6. Broken fan belt.
   a. Inspect fan belt.
   b. Replace fan belt.

5.7 Code 197 – Coolant Level Low (Warning)

Logic:

Coolant level sensor signal is showing a low coolant level for greater 10 seconds.

Possible Causes:

1. Low coolant

Diagnosis and Repair:

1. Low coolant.
    a. Remove radiator cap and check that coolant is up to the required level.

5.8 Code 415 – Engine Oil Pressure Low (Shutdown)

Logic:

Engine oil pressure is below 26 psig (180 kpa) for greater than 10 seconds.

Possible Cause:

1. Lubricating oil level is low
2. External leak

Diagnosis and Repair:

1. Lubricating oil level is low.
    a. Check the oil level. Add oil, if necessary.
2. External leak.
    a. Inspect the engine and surrounding area for external oil leaks.
    b. Contact your local dealer if a leak is present.

5.9 Code 421 – Engine Oil Temperature High (Warning)

Logic:

The control has detected the engine oil temperature has exceeded the warning threshold.

Possible Cause:

1. High ambient temperature
2. Enclosure air intake blocked
3. Coolant level is below specification

Diagnosis and Repair:

1. High ambient temperature.
    a. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Enclosure air intake blocked.
    a. Inspect for dirt, debris, or obstructions.
    b. Remove blockage or snow/ice buildup as applicable.
3. Coolant level is below specification.
    a. Check coolant level.
    b. Add coolant as necessary.

5.10 Code 441 - Battery Voltage Low (Warning)

Logic:

Battery voltage low.

Possible Causes:

1. Loose or damaged battery cable connections

Diagnosis and Repair:

1. Loose or damaged battery cable connections.
    a. Inspect the battery cable connections.
        i. Inspect connections for corrosion.
        ii. Inspect connections for loose connections.

5.11 Code 488 – Intake Manifold Temperature High (Warning)

Logic:

Engine intake manifold temperature has exceeded 185 °F (85 °C) for more than 90 seconds.

Possible Cause:

1. High ambient temperature
2. Enclosure air intake blocked
3. Coolant level is below specification
4. Radiator core fouled
5. Enclosure air discharge blocked
6. Broken fan belt

Diagnosis and Repair:

1. High ambient temperature.
    a. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Enclosure air intake blocked.
    a. Inspect for dirt, debris, or obstructions.
    b. Remove blockage or snow/ice buildup as applicable.
3. Coolant level is below specification.
    a. Check coolant level.
    b. Add coolant as necessary.
4. Radiator core fouled.
    a. Inspect for dirt, debris, or obstruction on core.
    b. Remove obstructions or debris, and clean the radiator core.
5. Enclosure air discharge blocked.
    a. Inspect for dirt, debris, or obstructions.
    b. Remove blockage or snow/ice buildup as applicable.
6. Broken fan belt.
    a. Inspect fan belt.
    b. Replace fan belt.

5.12 Code 1438 − Fail to Crank (Shutdown)

Logic:

The engine failed to crank after the generator control received a start signal.

Possible Cause:

1. Dead or weak battery

Diagnosis and Repair:

1. Dead or weak battery.
    a. Verify battery voltage is at least 12 VDC.
    b. Charge or replace the battery as necessary.

5.13 Code 1472 - High AC Current (Shutdown)

Logic:

The generator output current has exceeded at least 150% of rated current.

Possible Causes:

1. Generator set overload

Diagnosis and Repair:

1. Generator set overload.
    a. Reduce the generator set load by powering off to unneccessary household appliances (examples: washer, dryer, air conditioning, etc.).

5.14 Code 5134 - Unknown Shutdown at Idle

Logic:

The generator set failed to start.

Possible Causes:

1. Fuel supply issue

Diagnosis and Repair:

1. Fuel supply issue.
    a. Check that the manual shutoff valves are open.

5.15 Code 5569 - Engine Combustion (Shutdown)

Logic:

Rapid rate of increase of intake manifold temperature detected.

Possible Causes:

1. Intake manifold overpressurization event
2. Faulty TMAP sensor
3. Faulty engine harness

Diagnosis and Repair:

1. Intake manifold overpressurization event.
    a. Inspect the hose couplings between the compressor outlet and intake manifold.
        i. Inspect the hose couplings for damage.
        ii. Inspect the clamps for damage.
    b. Inspect the turbocharger.
        i. Externally inspect the turbocharger for damage.
        ii. Inspect for loose or missing bolts on the compressor housing.
    c. Inspect the mixer.
        i. Remove the air cleaner and confirm there are no loose pieces within the mixer.

2. Faulty TMAP sensor.
    a. Check the intake air temperature with the GCP Display service tool or the intake manifold temperature with InPower. Confirm that the value is reasonable.
3. Faulty engine harness.
    a. Inspect the engine harness and the connector pins.
    b. Disconnect the engine harness connector from the extension harness.
    c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
    d. Inspect for evidence of moisture in or on the connector.
    e. Inspect for missing or damaged connector seals.
    f. Inspect for dirt or debris in or on the connector pin.
    g. Disconnect harness from ECM and sensor.
    h. Measure the resistance in each pin from ECM to sensor. Resistance should be 5 ohms or less.
    i. Repair or replace harness as necessary.

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